ELECTRICAL WORLD

A Consolidation of Electrical World, Electrical Engineer and American Electrician

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What in the World!

Radio City Music Hall, overlooking its manifest shortcomings as a place of entertainment for anything less than colossal spectacles, is a grand show by itself. With a ceiling which gives the impression of being roofless, because it is all roof, and with lighting effects and perfection in the mechanism of stage and scenery handling which is, to say the least, literally breathtaking, this theater is an inexhaustible source of refreshing ideas. We present the story of the technical electrical accomplishments, or such of them as may be crowded into five pages.

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Just about the time that it seems pretty well established that no further progress toward economies and improved designs may be made in a certain branch of the electrical art some one is almost sure to upset the know-it-alls. There is distribution, for example. Down in Memphis the engineers got busy on the basis that something could be done—and did it. Perhaps not applicable in the same way in some other communities, but nevertheless proving that the millennium is not yet.

•

Can electric house heating become a permanent utility load upon a strictly commercial basis? Canada tried out 31 installations last winter, decided that it was fine for the utility which had excess power to dispose of, particularly hydro, and dandy for the fairly well-to-do customers, which probably excludes most of the Johns and Marys by any definition of well-to-do-ness.

NRA MEMBER U.S.
WE DO OUR PART

AUGUST 26, 1933

Contents, Copyrighted, 1933, by McGraw-Hill Publishing Company, Inc.
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Electrical World articles are indexed in Industrial Arts and Engineering Indexes, available in public libraries

Published weekly, price 25 cents a copy. Subscription rates—United States, Mexico and Central and South American countries $5 a year. Canada, including duty, $7.50 a year. All other countries $9, or 45 shillings, a year. Entered as second-class matter January 20, 1907, at Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U.S.A. Cable address MCGRAWHILL, New York. Member A.B.P. Member A.B.C.

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W.C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Greenville, S. C. James H. McGraw, Chairman of the Board; Malcolm Muir, President; James H. McGraw, Jr., Vice-President and Treasurer; Mason Britton, Vice-President; Edgar Kobak, Vice-President; H. C. Parmelee, Vice-President; Harold W. McGraw, Vice-President; B. R. Putnam, Secretary.

NOW

A *Protective Case*

for the Older Types of Watt-hour Meters

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NOT long ago, General Electric introduced a protective case for G-E Type I-16 and other modern types of single-phase watthour meters. It was widely accepted, and many thousands have been installed.

General Electric now offers a case similar to the first one, except that it is especially designed to accommodate older types of single-phase watthour meters; namely, those built as far back as 15 or 20 years. It will also accommodate modern types of meters.

Die-cast of aluminum — strong, durable, and noncorrodible — these cases completely protect meters from wind, rain, snow, and sleet. They also protect revenue, because access to a meter is impossible without leaving positive evidence of tampering.

Bulletin GEA-1243C gives complete information about these two cases. For a copy, address the nearest G-E office, or General Electric Company, Dept. 6A-201, Schenectady, N. Y.

FOR OLDER TYPES

G-E protective case for the older types of single-phase watthour meters

FOR MODERN TYPES

G-E protective case for Type I-16 and other modern types of single-phase watt-hour meters

600-48

GENERAL ELECTRIC

ELECTRICAL WORLD

Established 1883. McGraw-Hill Publishing Company, Inc.

for the Week Ending

August 26, 1933

Utility Code Stirs Further Doubts

JUST WHAT fate awaits the electric light and power industry code, presented to the NRA by the Edison Electric Institute several weeks ago, appears problematical. Just as uncertain remains the ultimate attitude to be expected of state commissions in regard to the potential conflicts of authority implied and the general policy in regard to rates and increased costs under reemployment agreements.

Officially NRA says nothing. Unofficially individuals of its staff have expressed doubt as to the ability of NRA to bring about higher wages and shorter hours throughout the utility industry should state regulatory bodies definitely object. It is considered that in court actions state authority and jurisdiction would in all likelihood be upheld. The code itself awaits hearings which have not as yet been scheduled. The NRA has refused to accept responsibility for increased gas or electric rates which may result from code acceptance by utilities.

New Hampshire Commission asks that utilities hold off

First, and only one, of the state regulatory bodies to interfere with utility participation in the NRA, the New Hampshire Public Service Commission late last week through Commissioners Mayland H. Morse and H. Styles Bridges advised utilities there not to sign any NRA code until the commission gave its approval. Chairman Morse stated:

The commission feels that the public utilities should not go into this hastily with snap judgment on a popular wave, but should give it full study. New Hampshire is a small state and operating expenses of public utilities should be kept down. We do not want any utility to sign a code until the commission approves it, as it would approve any other managerial or operating contract.

If operating expenses are increased there will follow, presumably, a flood of petitions to the commission for rate advances. There are a number of electric light companies, telephone companies, nine gas companies, two street railways, a number of bus lines and water companies in New Hampshire. If all applied for increases in rates there would result great delay before the commission could act.

This does not mean that we do not want to co-operate with the NRA or the federal government. We do, but we feel that this is no time for hasty action that may be regretted later on.

Commissioner Bridges stated:

So far as we can determine, General Johnson expects the increases in the cost of doing business to be passed on to the consumer. The New Hampshire commission is not certain that it would permit a public utility to increase rates to consumers simply because the companies signed a code.

No New Hampshire utilities have signed the federal code thus far.

Many electric utilities in various states have specifically indicated in the communities they serve that they would sign such a code as that which has been submitted for consideration to the NRA. Some have already increased the number of employees and the amounts of payrolls to meet the terms of the code submitted.

Other codes under way

Action and discussion upon other electrical industry codes are being had and the Radio Manufacturers Association, it has been announced by Deputy W. L. Allen, has withdrawn its request for exemption from the code of fair competition for the electrical manufacturing industry and has notified the administrator that the radio industry will comply with all the provisions of the code negotiated by NRA with N.E.M.A.

The National Electrical Wholesalers Association is preparing to submit a code at an early date.

The lighting equipment industry through the Artistic Lighting Equipment Association has submitted a code.

The National Battery Manufacturers Association has presented a code on behalf of the electric storage and wet primary battery industry which was scheduled for a hearing late this week.

▼

Induction Heating Applied to Enamel-Baking Process

At the sheet metal parts division of the Plymouth Motor Car Corporation, Detroit, Mich., heat is being applied for the baking of enameled surface by electrical induction in the metal covered by the enamel. Induction heating is not new, but previous commercial applications have been for melting furnaces and with the use of alternating current of high frequencies.

In the three ovens now in operation at the Plymouth plant for baking enamel on thin metal parts such as radiator shells, headlight bodies, etc., the heating is accomplished in two at 180 cycles and in the third at 360 cycles. The application of these comparatively low frequencies to induction heating is the work of E. L. Bailey, formerly with the General Electric Company in Detroit, who has devoted the past few years to the development of the idea and is now working the idea out commercially under contract in the Plymouth factory.

A feature of the new type of enameling oven, appreciated by the men who operate them, is that they are comparatively cool. The temperature gradient in these ovens is from the work to the oven wall rather than from the wall to

the work as is the case in ovens heated by radiation or convection, so that the air temperature in the ovens is about 100 deg. lower than that of the work.

▼

National Rural Project Issues Final Report

With some of its work unfinished, but with provisions made for carrying that out, the national rural electric project at College Park, Md., has terminated its activities. A report, just released, has indicated the accomplishments of the past five years.

Organized in June, 1928, through the co-operation of representatives of the National Committee on the Relation of Electricity to Agriculture, the National Electric Light Association, University of Maryland and Consolidated Gas, Electric Light & Power Company this project was established to expire June of this year.

Equipment placed in use was, upon the completion of the project, to the extent of 93 per cent absorbed through purchase by the farmers who had co-operated.

▼

Tennessee Authority Announces Power Policy

Definitely stating its guiding policy in regard to private and public developments, existing and contemplated, in the district under its supervision the Tennessee Valley Authority issued the following statement late this week:

The business of generating and distributing electric power is a public business. Private and public interests in the business of power are of a different kind and quality and should not be confused. The interest of the public in the widest possible use of power is superior to any private interest. Where the private interest and this public interest conflict the public interest must prevail.

Where there is a conflict between public interest and private interest in power which can be reconciled without injury to the public interest, such reconciliation should be made. The right of a community to own and operate its own electric plant is undeniable. This is one of the measures which the people may properly take to protect themselves against unreasonable rates. Such a course of action may take the form of acquiring the existing plant, or setting up a competing plant, as circumstances may dictate.

The fact that action by the Authority may have an adverse economic effect upon a privately owned utility, should be a matter for the serious consideration of the board in framing and executing its power program, but it is not the determining factor. The most important considerations are the furthering of the public interest in making power available at the lowest rate consistent with sound financial policy, and the accomplishment of the social objectives which low cost power makes possible. The Authority cannot decline to take action solely upon the ground that to do so would injure a privately-owned utility.

To provide a workable and economic basis of operation, the Authority plans initially to serve certain definite regions and to develop its program in those areas before going outside. Every effort will be made by the Authority to avoid the construction of duplicate physical facilities, or wasteful competitive practices. Accordingly, where existing lines of privately-owned utilities are required to accomplish the Authority's objectives, as outlined above, a genuine effort will be made to purchase such facilities from the private utilities on an equitable basis.

Accounting should show detail of costs, and permit of comparison of operations with privately-owned plants, to supply a "yardstick" and an incentive to both private and public managers. The accounts and records of the Authority as they pertain to power will always be open to inspection by the public.

▼

Earth-Generated Steam to Serve Italian Railways

That part of the Fascist state railways operating on a 160-mile section between Rome and Florence will be served by electrical energy generated by natural steam emerging from the earth near Livorno in Tuscany.

Steam is to be obtained from a geyser said to develop 220,000 lb. an hour at a pressure of nearly 60 lb. per square inch and a temperature of 190 deg. C. This source, used in conjunction with other smaller geysers, is said to be capable of supplying a generating capacity of 20,000 kw.

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Georgia Commissioners Balked

Unless the Appellate Court holds to the contrary, the five ousted members of the Georgia Public Service Commission will not be able to obtain a court review of the Governor's action in removing them, for Judge E. E. Pomeroy, in the Fulton Superior Court, has refused to sanction their applications for a certiorari, which would have brought their cases into court.

▼

Wholesalers Discuss Code

Major discussion at the meeting last week of the National Electrical Wholesalers Association centered around the NRA code under consideration by that electrical industry group. That a code will be presented to Washington for early consideration by NRA officials seems assured. Constitutional amendments to alter the eligibility clauses for association membership were approved as proposed, previous limitations having been thereby lifted.

New Energy-Storage System Offers Unusual Features

Development of a new system for the storage of off-peak energy, differing from the Ruths steam accumulator plan or pumped storage hydro schemes, has been undertaken abroad. F. Marquerre of Mannheim, Germany, has, in collaboration with engineers of the Escher Wyss Engineering Works, Ltd., been responsible for the process and has vested his rights in the latter organization. The plan, which may be used in connection with either hydro or steam stations, is said to be low in cost and to be applicable anywhere.

This thermodynamic storage process involves a self-contained regenerative system which is in its essentials wholly independent of any fuel. Heat is pumped from a low to a high temperature level by means of a heat-pump (turbo-compressor) and the energy subsequently recovered in a steam turbine. Thus water vapor is withdrawn, by means of the turbo-compressor driven by surplus electrical energy, from a water storage reservoir, compressed and condensed in a receiver. This accumulator is then discharged through a steam turbine producing peak load in the usual way. The exhaust steam is condensed to return to the reservoir. In practice this involves a machine which alternately works as a motor and as a generator, depending upon whether it is linked to an accompanying compressor or turbine.

According to Herr Marquerre, the efficiency of such an installation is to a large measure dependent upon the amount invested in plant and equipment. With average conditions of first cost an efficiency of between 48 and 50 per cent may be looked for. This includes all losses with a single daily discharge at fairly constant load. A value of 45 per cent may be achieved even under unfavorable conditions.

In the case of a projected 15,000 kw., to supply about 30,000 kw.-hr., it was found that including the price of the building and equipment, but excluding the cost of the ground, such an installation could be made for roughly 245 Swiss francs ($61) per kilowatt maximum output.

▼

Refrigerator Prices Up

Increase in the price of electric refrigerators effective at once has been announced by R. C. Cosgrove, manager refrigeration department of the Westinghouse Electric & Manufacturing Company. In commenting on the price increase Mr. Cosgrove stated: "With the price of raw materials and labor substantially advanced, it has been found

necessary to increase retail price of the finished product to maintain a sound merchandising program and to stabilize production. Prices of some of the raw materials used in the manufacture of our product have advanced, in many cases, as high as 100 per cent within the past few months . . ."

▼

New York Rate Hearings Bring $8,870,000 Cut

Characterizing as "a shocking departure from the law and basic principles which govern the fixing of fair and reasonable rates" an order of the state Public Service Commission directing that New York City and Westchester electric companies make rate reductions calculated to amount to $8,870,000, George B. Cortelyou, president of the Consolidated Gas Company, directed that an application to the commission to reconsider its action will be filed. This was done late this week. Mr. Cortelyou did not specify the course to be taken by the companies in the event that the commission refused to reconsider.

The cut, 6 per cent on all metered sales, will, according to the commission, reduce the companies' charges to consumers by approximately $8,900,000 in the year beginning September 1, for which period the order was made effective. This order was adopted after the defeat of a motion at a meeting of the commission by Chairman Maltbie for a reduction of 10 per cent, or $15,000,000. Mr. Maltbie's opinion recommending the larger reduction was based upon the size of the surpluses of the companies, the excess over 6 per cent on the stated value of common stock of each company, the amount of dividends paid on such common stocks and the company reports as to book values. Commissioner Brewster offered a dissenting opinion, questioning the legality of this recommendation. Mr. Maltbie then voted to agree with Mr. Brewster "in order that consumers may have some reduction immediately."

The organizations affected, all subsidiaries of Consolidated Gas Company, are New York Edison, United Electric Light & Power, Brooklyn Edison, New York & Queens Electric Light & Power and Bronx Gas & Electric. Two other companies figured in the hearings. Westchester Lighting Company was ordered to reduce its rates by 3 per cent and Yonkers Electric Light & Power Company was excluded from the provisions of the rate order.

President Cortelyou protests

"Since 1907 these companies," Mr. Cortelyou stated in his protest, "have been regulated by the state of New York so their rates and capitalization have been matters of constant study and approval by the commission. During the period of high prices the rates were not advanced, but on the contrary were decreased. In the year 1931, by negotiation with the commission, a rate reduction, intended to be $5,500,000, was put into effect in New York City. In practice this amounted to more than $8,500,000. By further negotiation Westchester's rates were reduced $1,500,000. For the year 1932 the net earnings of the companies decreased an additional $4,000,000, because of lessening sales of electricity. In 1933 $5,000,000 of additional annual taxes were imposed by the federal government. These items total $19,000,000 annually.

"As to alleged increases in dividends, the entire ownership of the Consolidated Gas group of companies, except a small number of shares, is represented by the ownership of the common stock of the Consolidated Gas Company of New York which is held by more than 100,000 stockholders. This company in April of this year reduced its dividend by 15 per cent. The dividends paid by the New York Edison Company and by the Westchester company were reduced in 1932. The only increases from other companies were small in amount and had no relation to what investors in the enterprise received.

"The hearings of the Public Service Commission were summarily closed before the code for the electric light and power industry had been approved by the National Recovery Administration. On Tuesday of last week our companies executed the President's Re-employment Agreement, the effect of which will be to add a large number of employees and a very substantial amount to our payrolls. In addition to these direct labor costs, coal, oil and the other many commodities which enter into our operating costs will be increased. From my long experience in public life and in business in the city of New York I regard the action of the Public Service Commission as being entirely contrary to the spirit and purpose of the great recovery program undertaken by the President of the United States . . . Washington asks us to proceed in one direction, the Public Service Commission of the State of New York wants us to proceed in another direction. This we cannot do and maintain the high quality of safe and adequate service to our customers."

Federal-state conflict denied

Taking issue with Mr. Cortelyou, after the latter's statement had been published, Milo R. Maltbie, chairman of the commission, said: "Mr. Cortelyou states that the Public Service Commission wants the companies to proceed in one direction and that 'Washington' wants them to proceed in another. The commission asks the companies to reduce rates and I challenge him to produce one statement from 'Washington' or the federal administration which asks the utilities to increase rates. As to the statement that the hearings 'were summarily closed,' his attention should be called to a fact which perhaps he has overlooked, namely, that the hearings occupied nearly three months; nothing summary about that. Further, at the time they were closed the companies involved had not signed any code; as a matter of fact, the code has not yet been approved by the national administration . . ."

The chairman contended previously that the New York electric companies "have not heretofore borne their fair share of the depression," and they "should not only be willing but anxious to assume a generous share of the burden from which they have so long escaped."

No indication of the course to be followed by the commission with regard to the intended application for a reconsideration of the order has been given, other than by a statement from Mr. Maltbie that the commission would consider such an application at its next meeting after the time of filing.

Faster, Faster, FASTER

First the campaign for employer cooperation (terminating, so far as the President's re-employment agreements are concerned, but not NRA code formulations, on Labor Day). Then the consumers' drive (due to start next week). General Johnson's plea for federal financial aid for hard-pressed industry points a significant signpost along the path. A faster tempo in activities to promote recovery seems more than likely.

Figures of the week show:

- Carloadings up 3 per cent.
- Energy production turns upward.
- Bituminous coal output off.
- Steel production drops further from August peak.
- Lumber production up, shipments off, orders off.
- Automobile output steady.
- Security and commodity markets rally.
- General business indexes continue decline.

Telltales of the week:

- Rising retail prices a problem to NRA.
- General Johnson denies boycott under Blue Eagle, but would halt sales elsewhere.
- Keeping the dollar depressed a problem.
- Excursions into price-fixing probable.

▼

Power Survey Authorized

That survey of the power resources of America, including costs of energy production and distribution (ELECTRICAL WORLD, August 12, page 195), to be made by the Federal Power Commission at a cost of $400,000 has been formally authorized by President Roosevelt.

Coming Meetings

Illuminating Engineering Society—Delavan, Wis., August 28-31. D. W. Atwater, 29 West 39th St., New York.

Pennsylvania Electric Association—Bedford Springs, Pa., September 6-8. A. B. Miller, Harrisburg, Pa.

Rocky Mountain Electric Association—Santa Fe, N. M., September 11-13. George E. Lewis, Gas and Electric Bldg., Denver, Colo.

International Association of Electrical Inspectors—Chicago, Ill., September 11-14. V. H. Tousley, 612 No. Michigan Ave., Chicago.

National Electrical Exposition—New York, N. Y., September 20-30. Ralph Neumuller, 480 Lexington Ave., New York.

American Welding Society—Detroit, Mich., October 2-6. M. M. Kelly, 29 West 39th St., New York.

National Safety Congress, Public utilities section—Chicago, Ill., October 2-6. C. B. Boulet, Wisconsin Public Service Corp., Milwaukee, Wis.

National Association of Railroad and Utilities Commissioners—Cincinnati, Ohio, October 10-13. James B. Walker, 270 Madison Ave., New York.

Association of Iron and Steel Electrical Engineers—Pittsburgh, Pa., October 17-19. John F. Kelly, Empire Building, Pittsburgh.

▼

System Load Building Planned by Georgia Power

Proposing to add at least $767,000 to its annual revenue, Georgia Power Company is undertaking a load-building campaign in which no less than 47 new employees will be added to the sales organization and in which $180,000 will be spent for salaries, expenses and advertising. All company employees will assist in the program.

This program embraces all fields of energy sales and for convenience the following divisions and activities have been established:

Merchandise—More intensive sales assistance in the field; salesmen for promotion of all commercial cooking, heating, refrigerating and air-conditioning equipment; additional advertising; additional salesmen as increased merchandise sales warrant them; employee sales promotion men to promote general employee selling of appliances; co-operative demonstrations and advertising with dealers; synchronization of company sales plans with those of dealers; promotion of "return to the service" campaign designed to get old customers back; the rental of 500 electric ranges and 250 water heaters in homes already wired for the appliances.

Home Service—Minimum number of 22,000 visits to homes of customers; estimated number of 1,500 lecture-demonstrations; plans to keep pace with increased merchandising activities.

Home Lighting—Potential residential lighting market among present customers set at 108,800,000 kw.-hr. a year, or 75,800,000 kw.-hr. a year more than present sales to customers. Plans call for home lighting specialist; training of home economics force in simple home lighting instruction, training of all company employees in better lighting, contacts with contractors, dealers and architects, advertising on need for adequate home lighting, lectures before organized women's clubs, home contacts and recommendations, employee lamp sales.

Power Sales, Industrial Heating and Air-Conditioning—Power salesmen will be added to assist in obtaining new power load. Two salesmen will be employed to promote the sale of industrial heating units. One new salesman will be employed to promote air conditioning.

Commercial, Industrial and Street Lighting—Thirteen salesmen will be added to the personnel of the lighting service division.

Rural Lines—Intensive efforts will be made to secure new residential and commercial customers; small power load will be actively solicited; promotion will be put on pumps, water heaters, ranges and refrigerators; street lighting will be developed in small communities; promotion of more adequate housewiring will be undertaken; aggressive attempts will be made to develop the use of electricity in agricultural applications, such as dairy, truck and fruit-growing, poultry, irrigation, spraying, etc.

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Oregon-Santiam Resources Surveyed by Bureau

Total potential water power of the Santiam River Basin in Oregon, without storage, is estimated at 143,000 hp. for 90 per cent of the time, according to engineers of the United States Geological Survey, Department of the Interior. With storage at proposed reservoir sites these figures would be increased to 351,000 and 492,000 hp. respectively.

The waters of the North Santiam River have been used for the development of power since 1866, when a power canal was built at Stayton. No large plants have been built in the basin, but there are eighteen small plants with a total installed capacity of 4,830 hp.

The report proposes fourteen power sites on the North Santiam River, two on Marion Fork, Puzzle Creek and Pamelia Creek, eight in the basins of the Breitenbush River and Little North Santiam River and twelve on the South and Middle Santiam Rivers; also seven reservoirs with a total storage capacity of 828,000 acre-feet.

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Wisconsin Utility Plans

At its recent closing session the Wisconsin Legislature passed a resolution proposing to allow the state to bond itself up to $700,000,000 for the purpose of going into the public utility business. To become law, however, the proposal needs similar action by the 1935 Legislature, and approval by the voters in a referendum election.

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A.I.E.E. Committees Formed for 1933-1934 Activities

At the August meeting of the board of directors of the American Institute of Electrical Engineers President Whitehead announced the committee appointments for the administrative year beginning August 1, 1933. The chairmen of major committees are as follows:

Executive—J. B. Whitehead, president of the Institute.

Board of Examiners—H. Goodwin, Jr., consulting engineer, Philadelphia, Pa.

Code of Principles of Professional Conduct—C. E. Stephens, Westinghouse Electric & Manufacturing Company.

Co-ordination of Institute Activities—E. B. Meyer, United Engineers & Constructors, Inc.

Economic Status of the Engineer—C. O. Bickelhaupt, American Telephone & Telegraph Company.

Legislation Affecting the Engineering Profession—W. I. Slichter, Columbia University.

Award of Institute Prizes—R. N. Conwell, Public Service Electric & Gas Company.

Standards—A. M. MacCutcheon, Reliance Electric & Engineering Company.

Technical Program—R. N. Conwell, Public Service Electric & Gas Company.

Technical committees

Automatic Stations—D. W. Taylor, United Engineers & Constructors, Inc.

Communication—H. S. Osborne, American Telephone & Telegraph Company.

Education—L. A. Doggett, Pennsylvania State College.

Electric Welding—K. L. Hansen, consulting engineer, Milwaukee, Wis.

Electrical Machinery—S. L. Henderson, Westinghouse Electric & Manufacturing Company.

Electrochemistry and Electrometallurgy—Warren C. Kalb, National Carbon Company.

Electrophysics—Joseph Slepian, Westinghouse Electric & Manufacturing Company.

General Power Applications—M. R. Woodward, Babcock & Wilcox Company.

Instruments and Measurements—W. B. Kouwenhoven, Johns Hopkins University.

Applications to Iron and Steel Production—F. O. Schnure, Bethlehem Steel Company.

Production and Application of Light—J. W. Barker, Columbia University.

Applications to Mining Work—E. B. Wagner, Lehigh Valley Coal Company.

Power Generation—H. W. Leitch, United Electric Light & Power Company.

Power Transmission and Distribution—D. M. Simmons, General Cable Corporation.

Protective Devices—R. T. Henry, Buf-

falo, Niagara & Eastern Power Corporation.

Research—Chester W. Rice, General Electric Company.

▼

United Corporation Omits Common Dividend

Omissions and reductions of dividends by properties in which United Corporation has large holdings has led, in turn, to the dropping of the dividend on its common stock by that top-holding company. Dividends previously were at the rate of 10 cents a share quarterly. Dividends in the preference stock are being maintained.

United Corporation, sponsored by J. P. Morgan & Company, owns large blocks of stock in Niagara-Hudson Power, Columbia Gas & Electric, United Gas Improvement, Public Service Corporation of New Jersey, Commonwealth & Southern and Consolidated Gas Company of New York.

Large owners of United Corporation are St. Regis Paper Company, Eastern States Power Corporation and American Superpower Corporation.

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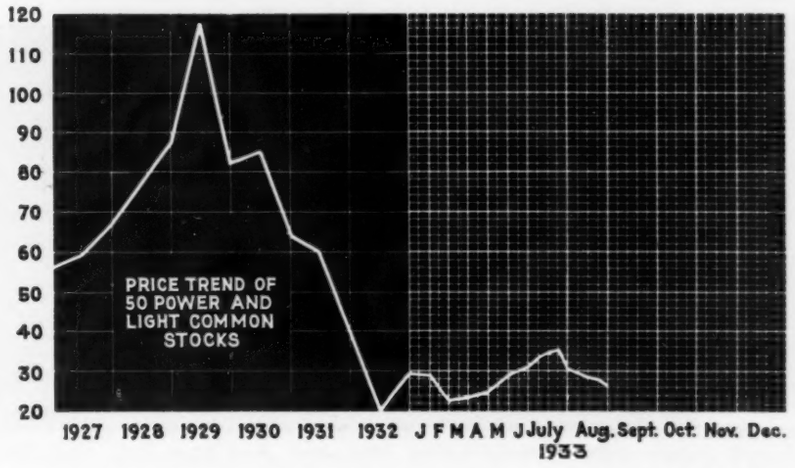
Cities Service Securities in Oklahoma Tangle

Apparently as an aftermath of the withdrawal from the marketing of Cities Service securities by Henry L. Doherty & Company (ELECTRICAL WORLD, August 5, page 165) and because of some unusual provisions of the Oklahoma laws, the registration of securities of the Cities Service Company, Cities Service Gas Company, Cities Service Gas Pipe Line Company, Cities Service Power & Light Company and the Empire Oil & Refining Company, heretofore made by notification and the filing of sworn statements by the companies or by Henry L. Doherty & Company for them that they met qualifications necessary under Oklahoma securities laws, has been revoked by State Securities Commissioner William M. Franklin. The revocation order will be set aside if satisfactory proof is submitted showing said companies are entitled to such registration under Section 7 of the state securities law.

Commissioner Franklin said that registration by notification is to be the filing of sworn statements giving required information under terms of the state securities act. Otherwise securities must be registered by qualification.

Utility Stocks Continue to Weaken



Under market pressure, due largely to developments interpreted adversely, utility common stocks slipped lower this week in a market which was generally stronger. "Electrical World" average 27.2; last week 27.7.

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Current Earnings Reports of Electric Light and Power Companies

Operating Companies

	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
Cleveland Electric Illuminating (Year ended June 30)					
Gross earnings	$22,226,463	$24,882,613	—10.7	68	64
Net earnings	7,062,566	9,050,829	—21.9	..	..
Net balance	4,295,510	6,238,865	—31.2	..	..
Detroit Edison (Year ended July 31)					
Gross earnings	41,416,005	46,052,341	—10.1	70	68
Net earnings	12,369,905	14,570,230	—15.2	..	..
Net balance	5,863,847	8,549,806	—31.4	..	..
Duquesne Light (Year ended June 30)					
Gross earnings	23,831,342	26,609,711	—10.4	43	42
Net earnings	13,517,119	15,292,949	—11.7	..	..
Net balance	9,599,671	11,587,669	—17.2	..	..
Kansas City Power & Light (Year ended June 30)					
Gross earnings	14,393,590	14,661,277	—18.3	58	57
Net earnings	6,014,966	6,261,749	— 3.9	..	..
Net balance*	3,488,150	4,246,035	—17.9	..	..
Milwaukee Electric Railway and Light (Year ended June 30)					
Gross earnings	24,117,289	27,534,135	—12.4	81	80
Net earnings	4,321,045	5,413,324	—20.5	..	..
Net balance	253,256†	970,874	—126.0	..	..
Union Electric Light & Power (Mo) (Year ended June 30)					
Gross earnings	31,837,447	32,168,096	—10.3	56	56
Net earnings	14,061,061	14,025,699	0.2	..	..
Net balance	4,954,429	7,142,959	—30.5	..	..
Virginia Electric & Power (Year ended June 30)					
Gross earnings	14,752,672	16,304,570	— 9.5	64	66
Net earnings	5,346,029	5,585,073	— 4.3	..	..
Net balance	2,271,642	2,553,121	—11.0	..	..

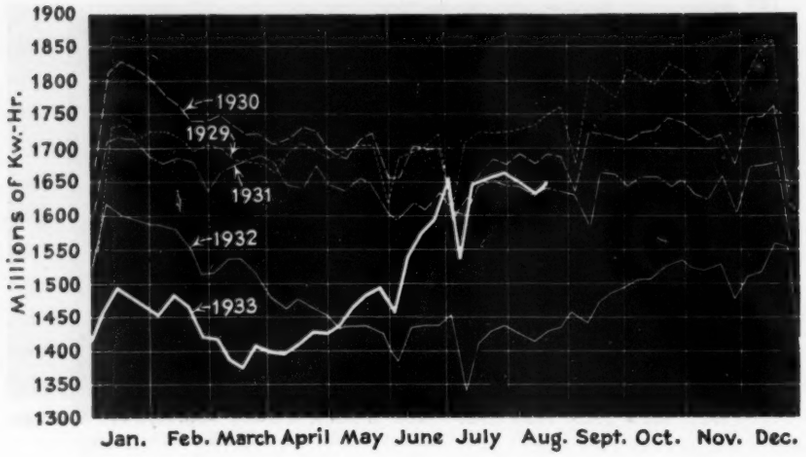
Holding Companies

	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
American Power & Light and subsidiaries (Year ended March 31)					
Gross earnings	$73,942,856	$83,081,584	—11.0	54	52
Net balance*	6,999,343	14,101,149	—50.2	..	..
Columbia Gas & Electric and subsidiaries (Year ended June 30)					
Gross earnings	74,692,686	83,449,806	—10.5	68	67
Net balance	8,117,695	12,620,164	—35.7	..	..
Electric Power & Light and subsidiaries (Year ended March 31)					
Gross earnings	72,033,989	78,725,726	— 8.5	60	56
Net balance*	2,997,801	9,265,737	—67.5	..	..
Engineers Public Service and constituent cos. (Year ended June 30)					
Gross earnings	43,501,909	49,611,133	—12.3	64	64
Net balance	679,582	3,143,346	—78.2	..	..
National Power & Light and subsidiaries (Year ended March 31)					
Gross earnings	69,511,545	77,083,816	— 9.8	60	60
Net balance*	7,770,465	10,688,271	—27.5	..	..
Philadelphia Company and subsidiaries (Year ended June 30)					
Gross earnings	45,548,628	52,907,445	—13.9	67	64
Net balance	3,436,210	7,442,966	—53.7	..	..
Public Service Corporation of N. J. and subsidiaries (Year ended July 31)					
Gross earnings	118,731,453	132,350,007	—10.3	65	66
Net balance*	26,786,263	30,235,057	—11.4	..	..

*Applicable to all dividends. † Deficit.

Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings—Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Net balance—Balance available from income for common stock dividends.

Energy Output Points Upward



A rise of 1.4 per cent over the preceding week brought the electrical energy output of central stations for the week ended August 19 just above the level of 1931, following a slight drop below the corresponding 1931 output in the week before. The Edison Electric Institute announces the production for the week as 1,650,205,000 kw.-hr. Compared with utility industry operations in 1932 this indicates a gain of 15.2 per cent, approximately the same as in the four previous weeks.

Regional percentages show but slight changes from the preceding week except on the Pacific Coast, now 9.3 per cent over 1932, against 6.8 a week ago.

Weekly Output, Millions of Kw.-Hr.

Week ended	1933	1932	1931	1930
Aug. 19.....	1,650	1,432	1,643	1,691
Aug. 12.....	1,627	1,415	1,629	1,677
Aug. 5.....	1,650	1,427	1,643	1,692
July 29.....	1,662	1,440	1,644	1,678
July 22.....	1,654	1,434	1,651	1,686

Per Cent Change from Previous Year

Region	Week ended Aug. 19	Aug. 12	Aug. 5
New England.....	+18.7	+19.4	+21.3
Middle Atlantic.....	+ 9.9	+10.8	+12.6
Central industrial.....	+20.4	+21.0	+22.7
Southern States.....	+18.1	+17.4	+17.0
Pacific Coast.....	+ 9.3	+ 6.8	+ 5.9
United States.....	+15.2	+15.0	+15.0

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Illinois Utilities Balk at Sales Tax Levy

Maintaining that "we do not consider that either electricity or gas is tangible property and will take the necessary legal steps to obtain a decision from the courts on this subject," George A. Ranney, vice-chairman of the Commonwealth Edison Company, Peoples Gas Light & Coke Company and Public Service Company of Northern Illinois, has announced their intention to fight the order of the Illinois department of finance that the 2 per cent occupational or sales tax apply to electricity and gas.

Can't pass tax along

The department ruled that the tax must be paid by the companies, not by the consumers, and that it shall be retroactive to July 1.

In opposing application of the tax and the manner of its collection by the state, the companies point to rules and regulations relating to the tax which specifically provide that the retailer may include the amount of the tax in fixing the price of the article sold.

"It appears to us that the state officials have singled out the public utilities as the only retailers in the state who must absorb the tax and who are not permitted, as all other retailers are, to include it in their prices to their customers," Mr. Ranney said.

He stated that the companies did not wish to impose any obstacle in the way of collection of "this exceedingly necessary revenue" to meet the unemployment situation nor did they desire to raise any question regarding the constitutionality of the law.

Involves $2,500,000 a year

"But," he added, "as trustees for upward of 100,000 stockholders we have no alternative other than to oppose the imposition of a tax which we believe to be improper under the existing law. The total amount of tax involved for our three companies for electricity and gas would amount to upwards of $2,500,000 per annum. This figure is more than 5 per cent of the total tax that Governor Horner is quoted as hoping to realize during the first year.

"This ruling, which seems so devoid of equity, prompts the companies to aggressively defend the rights of many thousands of security holders."

Output at New Peak, Britain Plans Sales Push

With the figures for July energy production showing new peaks for the month and year, Great Britain is planning under the financial aid of the Central Electricity Board to push energy sales and use in a way not previously attempted there.

July output by authorized undertakings was 913,000,000 kw.-hr., as compared with 807,000,000 in July of last year, the increase being equivalent to 13.1 per cent. As there were 26 working days in each month the figures are strictly comparable.

For the seven months of 1933 to date the output has been 7,401,000,000 kw.-hr., against 6,902,000,000 kw.-hr. in the corresponding period of 1932, an increase of 7.2 per cent. The relatively greater improvement for July is due, it would seem, to the extending use of industrial and domestic electrical appliances. In part it is also a reflection of improving trade.

Encouraged by the success of local sales drives a large-scale campaign, the first of its kind in the history of the British electrical industry, is planned. This will be undertaken in the fall and is the result of the reconstitution of the British Electrical Development Association. Membership of this body is now limited to authorized electricity undertakers and its main function is to foster the use of electricity by publicity and propaganda.

Hitherto the association's revenue fund has been hopelessly inadequate and no reserve funds have been available to finance special campaigns. It is to be supported, however, by the Central Electricity Board, which is responsible for the development of the national "grid" network.

The board is now engaged in considering prices at which electricity can be supplied in bulk in several new areas. In many cases the effect of the larger supplies being made available from the selected stations will be substantial reductions in prices to the consumer. The position of the supply companies should, however, be slightly improved. While they will be called upon to sell at lower prices to their customers, they will themselves obtain their supplies in bulk from the selected stations on much more economical terms.

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A Grand Coulee Warning

Addressing 10,000 people in Spokane, Wash., last week Senator C. C. Dill warned that unless Northwest power companies agreed to purchase power from the Grand Coulee plant and distribute it to the consumer at reasonable cost the United States is ready to build

its own transmission lines and go into the distribution business itself. He declared President Roosevelt to be determined that the people shall benefit from Grand Coulee dam and that they shall receive power at the lowest possible cost.

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Minnesota Water Act Declared Unconstitutional

Granting of water-power rights to the Minnesota Power & Light Company at Gabbro and Bald Eagle lakes by the 1933 state water levels act has been held unconstitutional in an opinion handed down at St. Paul by the state's Attorney-General, Harry H. Peterson.

That the matter may be taken to the courts to determine the legality of that part of the law was indicated here this week. Officials of the power company claim the state Legislature merely to have legalized what had already been done, as the Duluth firm has been operating dams at the two lakes since 1924, when the power plant at Ely was completed. The temporary dams were started by the Minnesota Utilities Company in 1923 and were taken over by the Minnesota Power & Light Company that fall and completed during the winter.

The water levels bill, which was passed last winter, including the special grant to the Duluth concern, follows the Shipstead-Nolan bill approved by the Congress of the United States, but regulating only state waters and lands. The congressional measure governs federal waters and forests and also includes the provision legalizing the local power project, it was explained, similar to the one included in the Minnesota state act.

The act was challenged by John B. Foley, chairman of the state Conservation Commission, who claimed the law granted a perpetual lease on an area of state land to the company, which he said was contrary to the state Constitution. The ruling made upheld the legality of the remainder of the act, which provides that no dam or addition may be constructed in Cook, Lake and St. Louis counties or natural water level or volume altered affecting state lands unless authority is first given by the state Legislature.

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Sub-Standard Materials Barred in No. Carolina

Following the passage by the General Assembly of North Carolina of an act making the sale of any electrical materials, devices and equipment not conforming to the provisions of certain established standards of quality a misdemeanor, punishable by fine or imprisonment, E. N. Canady, state electrical engineer and inspector of the Insurance Department, has notified inspectors in all cities and towns that the sale or gift of sub-standard electrical appliances is hereafter prohibited.

Inspectors have been further advised that devices listed by Underwriters' Laboratories may be accepted without further test. They are co-operating with retail dealers, giving them such information as will prevent any violation of the new law through ignorance of its provisions.

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British Lamp Makers Seek Exclusive Outlets

Interesting policies are being tried by the selling side of the British electric lamp industry, where associated manufacturers, virtually controlling the domestic market, have again taken the initiative against independent producers.

The Electric Lamp Manufacturers' Association, known as "Elma," has on a number of occasions in recent years, generally in the fall, reduced its prices for the range of lamps most commonly in demend for general lighting work. Independent makers have always kept their prices slightly below the Elma level, while the organized works affirm that Elma prices cannot be reduced, owing to the expenditure upon publicity and research, and that their policy of price maintenance means protection for the retailer.

It is not yet known whether September—the opening of the lighting season—will bring any change in the official list, but reductions are considered unlikely in view of further concessions now given by Elma to large-scale users on the approved list and to retailers. Users already entitled to discount are to have a bonus of 5 per cent if they buy none but Elma bulbs, and Elma retailers are to have a bonus of 6 per cent. The association has also made a bold bid to win the support of ironmongers, by whom a very large proportion of the domestic trade is handled, giving these traders, through their organization, a super-rebate of 1 per cent.

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T. V. A. Power Line Surveyed

Reporting to President Roosevelt late last week upon the progress made to date with the Muscle Shoals-Norris Dam-Tennessee Valley project, Chairman A. E. Morgan and David E. Lilienthal of the Tennessee Valley Authority, stated that aerial surveys were being made for the 240-mile high-voltage transmission line to link the existing and proposed developments. The estimated cost of the line, according to Mr. Lilienthal, is $6,000,000.

Major New Construction This Week

Motors, controls, transformers, etc., will be installed in Cleveland, Ohio, industrial oxygen plant of Keith Dunham Company. Cost about $100,000.

Oakman Brewing Company, Detroit, Mich., recently organized, has authorized plant to cost over $200,000.

Until September 6, City Water and Power Department, Los Angeles, Calif., asks bids for carrier current street-lighting control equipment (Specifications 3177).

Motors, controls, transformers, conveyors, etc., will be installed by duPont Rayon Company, Old Hickory, Tenn. Power plant to be enlarged. A $2,000,000 project.

Electric pumps, substation equipment and transmission line required for $1,200,000 irrigation project of Starr County Water and Improvement District No. 1, Rio Grande City, Tex.

Constructing Quartermaster, Mitchell Field, N. Y., has secured appropriation of $50,000 for underground electric system and $54,842 for coal storage and handling.

Sonoma Valley Brewing Company, Santa Rosa, Calif., plans $125,000 project.

Board of Essex County Freeholders, Newark, N. J., will purchase two generator units and auxiliary equipment for power plant at Overbrook Hospital, Verona. Fund of $180,000 being arranged.

Kennett, Mo., has authorized $140,000 for new city-owned electric light and power plant (Diesel) and distributing system.

Kansas Board Approves Municipal Line Extensions

By authority of the Kansas Corporation Commission, Kansas City, Kan., will extend its municipal light and power service outside the city limits.

According to James D. Donovan, president of the Kansas Association of Public Utilities, and production manager of the Kansas City plant, the order is of far-reaching importance, for many cities and towns of this state either have extended or plan to extend their services beyond the corporate limits.

The state commission found that the public utility was not required to obtain a certificate of convenience and necessity before extending its lines, as is required of a private utility.

The municipal light department is prepared to meet any appeal from the order, according to Mr. Donovan.

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New York Metal Prices

	Aug. 15, 1933 Cents per Pound	Aug. 22, 1933 Cents per Pound
Copper, electrolytic	9.00	9.00
Lead, Am. S. & R. price	4.50	4.50
Antimony	7.10	6.875
Nickel ingot	35.00	35.00
Zinc, spot	5.35	5.22
Tin, Straits	44.10	44.375
Aluminum, 99 per cent	23.30	23.30

As to Rates——

• Electric companies affiliated with the Consolidated Gas Company of New York filed a memorandum with the New York Public Service Commission last week opposing the establishment of temporary reduced rates for electric service (ELECTRICAL WORLD, August 19, page 232). Presented for the New York Edison Company, United Electric Light & Power Company, Brooklyn Edison Company, New York & Queens Electric Light & Power Company, Bronx Gas & Electric Company, Westchester Lighting Company and Yonkers Electric Light & Power Company, the brief asked that the commission's current proceedings looking toward rate cuts be dismissed on the grounds that the public interest at this time does not require a change in electric rates. "The commission," said the memorandum, "should be apprised of the grave possibility that monetary policies of the national government may cause inflation of price levels to an extent where the question may in the immediate future become one of a temporary increase in public utility rates." The memorandum also declared that there was no justification for tearing down the earning power of any legitimate enterprise, while the federal administration was striving to bring about economic recovery under a program of spreading employment.

Following the developments indicated previously, the New York Public Service Commission this week ordered electric light and power operating subsidiaries of the Consolidated Gas system to reduce their rates by 6 per cent (page 259).

• New York State Electric & Gas Corporation with the approval of the New York Public Service Commission will revise its rates to save consumers more than $500,000 annually. The lower rates become effective immediately in the Binghamton, Ithaca, Lancaster, Gowanda, Silver Creek, Sullivan County, Harlem Valley (South), Lockport and Walden districts. The general reduction is the result of a proceeding initiated by the commission on its own motion to investigate the rates of the company. After hearings were held the commission ordered the company to reduce its rates $600,000 over the rates charged in 1932. This order was based upon an allowance of a 6 per cent return on the book value of the company's average fixed capital for 1932 plus estimated working capital. The order provided also that the lower rates remain in effect one year after August 15, 1933, and thereafter unless otherwise ordered by the commission. The reduction of more than $500,000 now approved accomplishes most of the reductions ordered and further reductions are being prepared to carry out the remaining amount of reductions ordered. The recent reductions have resulted in the closing of the rate case brought by the city of Binghamton against the company for lower electric rates.

• North Carolina Corporation Commission has been requested by Governor Ehringhaus to start an inquiry into public utilities to determine whether their rates are fair and whether the utilities are reasonably taxed.

• Detroit Edison Company was ordered last week to cut its rates $1,500,000 a year by the Michigan Public Utilities Commission. The order was an outcome of the rate case filed by the city of Detroit in the Spring of 1932, on which hearings were continued during the present year, when several communities intervened, as did a group of manufacturers. The company is ordered to file revised schedules by August 26. Every class of consumer may benefit by the reduction, although the order does not provide for a general readjustment of rates. Chairman Kit F. Clardy explained that the commission may insist that home owners and commercial consumers benefit equally with industry. "It is up to the Detroit Edison to prepare new rate schedules cutting their income by $1,500,000 and to file them with us before September 1," members of the commission said. "We will then review the proposed new charges and decide whether the cut has been apportioned equally and fairly among all classes of customers." The ruling opinion holds that the testimony taken at the hearings shows a reduction of $1,500,000 to be warranted, but that the facts indicate that an audit and appraisal is not necessary. In starting the litigation, Detroit asked that the power charges be reduced at once under a temporary order and that the commission then proceed with an audit and appraisal that would lead to a complete rate readjustment.

• Consumers Power Company, operating in Pontiac, Mich., on a day-to-day agreement based on rates charged at the beginning of the agreement by the Detroit Edison Company, will modify its schedules to meet the newly instituted reductions of the Edison company.

• Missouri Public Service Commission has dismissed for want of jurisdiction an application by Major Frederick Schoenfeld of the Quartermaster's Corps of the army for a 10 per cent reduction in utility rates now paid by the army in Missouri. The reduction was asked for electric rates at the St. Louis medical depot; Richards' Field, Kansas City; United States rifle range, Arcadia, and Jefferson Barracks, near St. Louis. The order, written by Chairman John C. Collet of the commission, said: "It is not consonant with the principles of regulation to say to a utility that it must charge one of a number of customers of a class one rate and at the same time to make a higher charge to all other patrons of the same class. Neither is it within the power of the commission. Yet that is the very thing which the applications request, with no reason assigned therefor other than that the application is made at the command of the applicant's superior officer. No doubt that was an excellent reason for the filing of the application, but it certainly furnishes no ground for any action authorized by statute."

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Municipal Items

EAST POINT, GA.—Contracts for a $135,000 municipal electric power plant were canceled last week in a special session of City Council, when the ordinance providing for the plant was unanimously rescinded. Citizens hope to receive lower rates by action of the Georgia Public Service Commission or through the power which may be supplied through the Tennessee Valley Authority. The city now buys electricity from the Georgia Power Company. A municipal vote which was to have been held on the purchase of the machinery from the Fairbanks, Morse Company was automatically killed.

BELLEVILLE, ILL.—Preliminary plans for the construction of the proposed $1,600,000 municipal water plant were approved last week at a meeting of the City Council. Plans will be sent to Washington, where city officials will seek a loan of $2,000,000 for the construction of the plant from the federal government's public works fund. Specifications call for the construction of a small electric light plant which will serve as a feeder to the water plant.

MORNING SUN, IOWA—Proposition to establish, maintain and operate a municipal light and power plant carried at special election August 11 by a vote of 336 for and 56 against. City has made formal request for a loan under the National Industrial Recovery Act to finance this project. Tentative estimate of cost $70,000.

ST. CHARLES, MO.—Authority to borrow $350,000 from the Emergency Administration of Public Works to finance the construction of a Diesel electric light and power plant and a distribution system was voted recently by the City Council. Under the ordinance, which was adopted by a 5-3 vote, Mayor W. S. O'Neal and the City Clerk are empowered to negotiate the loan and to enter into a contract under which the net revenue will be pledged for repayment of the loan for ten years, and as long thereafter as necessary. Citizens of St. Charles twice voted down proposals to issue $300,000 worth of bonds with which to finance the plant (ELECTRICAL WORLD, March 25, page 376). It again will be necessary to place the

proposition of municipal ownership before the people. The franchise of the Union Electric Light & Power Company expired last March 17 and has not been renewed.

LIBERAL, MO.—Division No. 2 of the Missouri Supreme Court last week sustained the validity of $22,000 in bonds voted by this city in 1931 for the construction of a municipal electric distribution system, with no provision for a city-owned power generating plant. Several taxpayers and the Ozark Utilities Company attacked the bond issue on the grounds that the constitutional provision authorizing bond issues for a city-owned electric plant contemplated a complete plant, and not merely a distribution system. Their contentions were overruled by the high court. Justice Tipton, who wrote the Supreme Court decision, maintained that the city had the power to issue such bonds and that it could under the Constitution issue bonds up to 10 per cent of the assessed valuation of property in the city for taxation for purchasing or constructing water works, ice plants, electric or other light plants, to be owned by the city, and he overruled a contention of the protestants that Section 12 limited such bonds to only 5 per cent of the assessed valuation. He said that Section 12-A of Article X "must not be given too technical or strict construction, so as to defeat the very purpose for which it was adopted."

EAST LIVERPOOL, OHIO—Report submitted to City Council by Loftus & Shover, Pittsburgh engineers, estimated the cost of a proposed municipal system at $1,251,891. Council deferred action on calling a vote at the November 7 election on a bond issue for the project. Peter F. Loftus, representing the Pittsburgh engineers, said the construction of the municipal plant probably would mean a 10 per cent reduction in rates.

OGDEN, UTAH—Petition bearing the names of 1,689 persons advocating municipal ownership and operation of a power plant was recently submitted to County Clerk Lawrence Van Dyke. The county clerk will check the names and eliminate any non-voters of record. The petition needs 1,610 voters to carry. The petitioners also submitted a model ordinance which the commission would adopt automatically by accepting the petition. The plan provides for financing of the power plant through bonds and specifies that the plant should be ready for operation not later than December 1, 1934. If the petition does bear sufficient eligible names it can be placed before the city commission, which will have 30 days to consider the proposal. If the commission rejects or tables the motion, the city recorder then will place it on the ballot in the next election to be held not sooner than 90 days following the submission of the proposal to the city commission.

TWO RIVERS, WIS.—Application is being made for a loan under the National Industrial Recovery Act to finance the construction of a municipal light and power plant. Preliminary report estimated the cost of the project at $240,000.

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Oklahoma Tax on Utilities

Two members of the Oklahoma Corporation Commission have signed an order directing utilities of the state to absorb the 1 per cent general sales tax which became effective July 10 and prohibiting them from passing it on to consumers. While electric utilities made no attempt to contest the action, one of the gas companies instituted proceedings with a view to making a court test to determine validity of the order.

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Street Lighting at $21 a Lamp

Although the total number of street lights in Chicago increased from 88,914 in 1931 to 93,013 in 1932, costs for operation and maintenance were reduced from $2,229,049.66 to $1,993,072.10, or a reduction in operation and maintenance average cost per lamp, including all sizes and types, from $25.06 to $21.42. These decreases, according to a note accompanying the tabulated costs in the 1932 report of the Chicago Department of Gas and Electricity, are in large part due to reductions in salaries of employees. It is probable that the 1933 report will show even greater savings over 1932 by a program of replacement of about 35,000 globe units with open-frosted lamps which will be completed in 1934 (ELECTRICAL WORLD, April 8, 1933, page 439.)

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Mexican Property Sold

International electric power and light service performed many years by the El Paso Electric Company has come to an end with the signing of an agreement for the sale of the company's distribution system in Juarez, Mexico, to the Compania Productora Mexicana de Luz Fuerza of the latter city for approximately $175,000. By the terms of the agreement the controversy between the El Paso Electric Company and the city of Juarez over the defaulting in payment of approximately 300,000 pesos for light and power service is settled. The city agrees to pay the sum due the company and to drop its suit against the company for 400,000 pesos for alleged damages caused by the company shutting off its electric current for non-payment of bills. The Compania Productora Mexicana de Luz Fuerza recently completed the construction of an electric generating plant which will be connected with the system purchased.

Electrical Progress in Latvia

With a total capacity of but 52,000 kw. the electricity supply enterprises of Latvia nevertheless involve 65 stations, of which 93 per cent are steam operated, 3 per cent are driven by internal-combustion engines and the remainder are hydro-electric. Output in Latvia advanced from 68,495,000 kw.-hr. in 1928 to 96,398,000 kw.-hr. in 1931, 75 per cent of which was supplied by a 35,000-kw. plant in Riga.

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Law Evasion in Nebraska?

Charging that the electric utility companies of the state "are attempting to evade" the provisions of a new law which prohibits them from collecting a service charge by increasing the rate for minimum consumption by rural patrons sufficiently to include the same sum they have been collecting as a service charge, Senator Pedersen has lodged formal complaint with the Nebraska Railway Commission. The specific complaint is against the Southern Nebraska Power Company. Utility men point out that it costs a minimum of $500 more investment in plant for the farmer than for the town customer and that they cannot continue rural service unless a return on this additional investment is reflected in returns. If the service charge is banned rates must be advanced. The railway commission will take jurisdiction of the complaints under a section of the law which gives them power to fix a proper rate where the company and the farm owner cannot agree.

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Russians Seek Wreckers

No longer seeking to pin on foreign engineers the blame for operating failures of Soviet power stations, Russian authorities have ordered a thorough new hunt for electric power station wreckers. First place is given to the Moscow power station, which figured in the trial of the Metropolitan-Vickers employees, and it is asserted that breakdowns continue and the real culprits remain undiscovered. A resolution passed by the Moscow Committee of the Communist party blames the directors of the power stations and officials, who still fail to understand that their negligence is wrecking the productive industrial life of the whole territory, and adds that the culprits must be found and brought to justice in order to restore labor discipline, which has become disordered.

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German Energy Use Rises

According to official reports, the consumption of electrical energy in Germany during the first half of 1933 was 7 per cent above the same half of 1932.

EDITORIALS

L.W.W.MORROW
Editor

Call a public relations council

UTILITIES face trying times these days. A hostile public sentiment, higher taxes, ordered rate reductions, governmental and municipal competition, radical agitation, lower earnings, code disputes—an accumulation of trials and tribulations. The facts must be faced and acted upon.

In the face of these conditions there is every reason to exercise courage and intelligence. There is a necessity for the entire electrical industry to pull together and to use the teamwork that has been so notable in the past. The manufacturers, the wholesalers, the contractors and the retailers have a heavy stake in the maintenance of a strong and prosperous utility industry and they should act aggressively to correct false statements and impressions concerning their partner in business. They should help create favorable public sentiment and they should help utility leaders to arrive at constructive public and business policies. There is a job to be done in creating a greater electrical business in this country. All members of the family are needed and all must be strong and healthy if the work is to be done quickly and well.

On the other hand, the utilities should take counsel and act courageously and intelligently. This is not the time for them to maintain silence or to turn the other cheek. Nor is it a time for them to use the outworn weapons of propaganda and publicity, whose amateurish and excessive use in the past partly explain the present public sentiment. The utilities need, however, to call upon their most expert leaders in public relations for counsel and suggestions so that action may replace confusion and inertia.

We believe that the utilities need a council of operating property executives; for example, Arkwright, Owens, Pack, Ferguson, Wagner, Dow and others who have both the ability and the experience and are in such intimate touch with the public and with conditions that they could arrive at agreements as to procedure to improve conditions whether through action on local properties or nationally. It is this type of executive and not the headquarters holding company official who has the information and experience needed to lead the utilities into the sunlight of public favor. There is no more necessary or more difficult task, and it must be done, for only the utmost courage and intelligence will ward off the present disastrous trend. If the utilities will do their part and take the lead the other members of the electrical family may be counted upon to do their utmost. Action is the only way out.

Loads for rural lines

THOUSANDS of miles of rural lines have been built by the utilities in recent years. This has been done, despite the questionable economic returns from the investments, because the service was needed and demanded. Construction practices and cost analyses have been made in many instances and a typical analysis is given in the splendid article by Mark Eldredge in this issue. Thus today the industry knows how to build rural lines at a minimum cost to give maximum service.

But this large investment should earn adequate returns. Sales efforts should be made to get increased rural loads so that these lines may make

profits. And, with the present agricultural recovery under way, this is a splendid time to sell rural service. Each utility can well afford to inaugurate an aggressive rural sales campaign this fall. The crops will soon be sold and winter is on the way. This is a very opportune time to sell the farmers more electric equipment and service.

The boon of indirect lighting

IN THE Marshall Field store in Chicago is an installation of wholly indirect lighting which is causing comment, not only among illuminating engineers, but among laymen as well. Customers, long familiar with the store, entering for the first time since the new lighting was turned on, are conscious of something different. Then they realize that the store seems larger, the ceiling higher and that the reason for these impressions is the absence of lighting fixtures. But where is the light coming from? Unless they ask, many of them leave the store with the mystery still unsolved.

The light sources are easy enough to find if one knows where to look for them or has enough experience to deduce their locations. But they are not apparent; they are just unobtrusively there, doing their work.

Artificial light has two functions. One, the more important, is illumination. The other is decoration. In neither is it necessary that the eye be attracted to, or even be conscious of, the light source. The light source may, of course, be an element in the decorative scheme, but there is nothing about its utilitarian function that requires its presence to be advertised or even apparent.

Probably if an excellent example of just lighting, such as this in Marshall Field's, could have been held up before the electrical industry thirty years ago the monkey tail style of fixture that even in this present day infests too many of our homes and stores would never have spread its curlicues so widely over the land. And wouldn't that have been a blessing? Even a lot of modern fixture and lighting unit design might happily be abolished from the sight of man if a proper appreciation of indirect illumination from concealed light sources could be brought home to illuminating engineers as well as to the public at large.

Taxation chickens come home to roost

POPULAR expectations of electric service rate reductions received a decided jolt recently in Massachusetts in two decisions of the Department of Public Utilities. In the cases of the Randolph & Holbrook and Lawrence companies the board in effect rejected petitions for lower rates, partly because present revenues do not warrant cuts in prices at this time and partly on account of anticipated increases in operating costs due to the 3 per cent tax on gross revenue, other excises and the possible results of the Recovery Act. It is a fair inference that not only will the commission weigh these factors in every rate case coming before it in the next few months and refuse to order rate cuts which deny a fair return to the power companies, but that it may be disposed to lend a sympathetic ear to applications for compensating rate advances if these become necessary. This is a courageous attitude in the face of present political hostility to utilities as evidenced in the punitive taxation soon to become effective, but it offers convincing evidence of the vitality of regulation in the Bay State, and may well be emulated elsewhere. In striking contrast is the Consolidated Gas decision in New York.

Some utilities will be able to absorb unfair tax burdens from revenue growth if business continues to improve; but this does not justify the imposition of such taxes. It is time to tell the general public specific facts about local situations, as Alex Dow has recently suggested; to defend the right of every properly run utility to a reasonable return on the service rendered; and to show in specific cases how further rate reductions must be retarded by the "soaking-the-utilities policy." Every progressive management deplores the necessity for rate increases, knowing that the growth of business is accelerated by downward trends. The consumer must pay all taxes in the end, but unfortunately many citizens fail to realize this.

Higher prices for electric service may have to come in some cases to keep rates above the confiscation level, and in other instances they may have to be sought in order to approach a reasonable return. Between these two limits is an unsatisfactory zone for capital to inhabit, and in the long run capital will fight shy of any class of investment in which a reasonable return is denied.

Farm Line Construction

Comparative costs shown.
Use 600-ft. spans on 30-ft. poles with copperweld conductors.
Intermediate poles and flying service used on secondaries.
Details of design and costs.

By MARK ELDREDGE

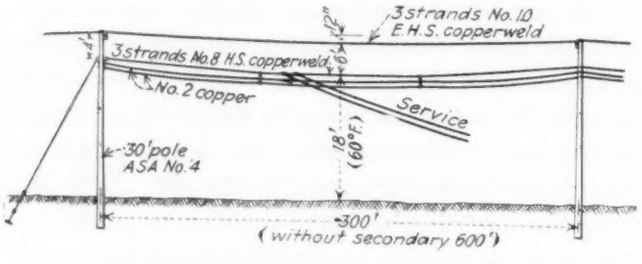
Chief Engineer, Memphis Power & Light Company

THE term "farm line" is here used to denote that type of line built to serve purely rural customers, such as a single-phase branchoff of some main, radial, rural feeder or a branchoff of a line serving a rural community. Its current-carrying capacity therefore can be rather small, but must be satisfactory to give reasonable regulation after allowing for the probable growth which may come in the following few years. The voltage used will probably be in the range of 6,600 to 13,200.

Because of the wide separation of customers, it is necessary that the cost of farm lines be kept at the very minimum and yet give satisfactory service. Each locality will require individual attention to adapt the design to the local conditions of weather, terrain, type of load, etc. The line here described was adapted to the conditions in the lower Mississippi Valley falling in the medium-loading zone.

Until two years ago many miles of rural lines had been built using No. 4 copper in 300-ft. spans on 35-ft. poles. These lines were very satisfactory, except for their cost in relation to the business, especially the additional farm business it was desired to secure in the thinly settled areas.

An analysis of the costs of the above lines showed 52 per cent went for labor and material in stringing the primary copper and 48 per cent for providing the supports, i.e., labor and material for erecting poles, crossarms, pins, insulators, hardware, etc. The conductor was necessary to carry the current, but the poles were of only secondary importance, being used merely to put the conductors out of reach in a position of safety. Here, then, was the place to make a cut in costs on the material unwanted but necessary and costing 48 per cent of the completed line. Obviously the only way to cut the cost on poles and accessories was to eliminate as many as possible by going to longer spans, so a study was made of lines, using conductor material of high tensile strength. Current-carrying capacity was hardly a factor for the voltage and loads involved.



Farm line with suspended secondary

Cost analyses made

The three or four minimum practicable sizes of copper alloys, copper-steel and aluminum-steel combinations were investigated. From sag tables the heights of poles were determined for various span lengths. Ice loading and wind pressure fixed the strength of poles to be used. With these factors settled, the next step was to estimate the cost per mile of line, using each size and type of conductor. The minimum cost for the Memphis conditions was found to lie in the use of a line conductor of three strands of No. 10, extra-high-strength copperweld, of 30 per cent conductivity, on 30-ft. class 4 poles in 600-ft. spans. Only grade "A" construction for medium loading was considered, first, because Memphis lies in the northern portion of the medium-loading zone; second, because high-grade construction would keep maintenance costs at a minimum. This is important, for with the distances involved minor maintenance would be expensive.

The new construction with 600-ft. spans uses only half as many poles as was necessary on the older No. 4 copper lines with 300-ft. spans, and in addition the newer line uses 30-ft. poles instead of 35-ft. poles. The pole top construction is just the same, using standard 8-ft. arms with four pins. The pole pins are used for single-phase extensions of 6,900 volts, phase to neutral. Later on, if more capacity is needed or three phases are required for a cotton gin, or other power customer, it is only necessary to add the other conductors on the end pins. Thus the design has flexibility, which is not possible on some types of farm lines, such as those using greater sags and a consequently greater pin spacing. In such cases 4-ft. or 6-ft. two-pin arms are used, with no provision for easily and cheaply increasing line capacity or supplying three-phase energy. The wider spacing would have another disadvantage, in that it would increase reactive drop, giving poorer regulation, which is quite a factor on those lines that are extended and extended until they are several miles in length. With the copperweld conductor 30-in. pin spacing is satisfactory.

The mention of 600-ft. spans on 30-ft. poles brings frequent inquiries regarding conductor vibration. This was considered at the time the design was accepted, and although very little information was available from actual experience and records, assurances were given that a three-strand conductor, being unsymmetrical, would have but slight tendency to vibrate under the conditions contemplated. No evidence of vibration has been observed during eighteen months of service with lines now totaling 30 miles.

The present-day cost of the older type of line using No. 4 medium hard-drawn copper on 35-ft. class 4 creosoted pine poles is $608 per mile of tangent line over flat terrain. This cost does not include tree trimming or right-of-way expense, as these are not pertinent to the question of comparative line design. Storeroom expense also is not included, as this is unusually high at the present time, especially for those companies having facilities for extensive operations.

The corresponding cost of a mile of the new line using three strands of No. 10 copperweld is $477, or a saving of 21.5 per cent. This would be much greater with normal copper and pole prices. For three-phase, four-wire lines the costs would be $904 for No. 4 copper and $803 for copperweld, or a saving of 11.2 per cent.

Tennessee is not laid out in square miles, so the county roads are anything but straight. They also bob up and down over the rolling hills, all of which might be thought to affect adversely the use of long-span construction. A check of all lines of primary only of this new type shows an actual average span of 497 ft.

Along with the design of primary lines must go that for secondaries. Spacing and height of poles must be economical for one as well as the other. Long-span, light conductors are out of the question, as high conductivity is required and besides no space is available on the 30-ft. poles.

Secondary problems solved

The solution of this problem was obtained through the use of an intermediate pole, thus raising the primary conductor at the point of greatest sag and giving a new sag only one-fourth as great. Space is then available for secondaries, provided they can be sagged nearly as flat as the primary. Some combination of copper and copper alloy, or copper and copperweld stranding, might have been used, but another and simpler arrangement was possible using stock materials.

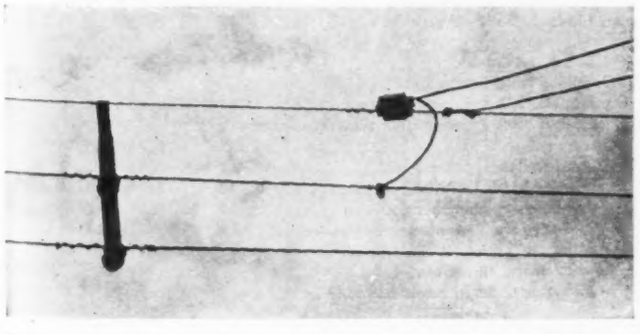
Three-strand No. 8 high-strength, 30 per cent conductivity copperweld is used for guying. By using this for the grounded neutral of the secondary it is possible to make it carry part of the weight of the other one, or two secondary conductors, which are usually No. 2 medium hard-drawn bare copper.

At two intermediate points in the span suspension racks are used. Not only do they suspend the copper in three 100-ft. spans, but they serve as spreaders to keep the bare conductors from getting together. In the same way that the new primary construction saves half the poles formerly used, the new secondary construction saves half the poles formerly used with plain copper on 150-ft. spans. The cost of adding two-wire secondaries to an existing primary line was $832 per mile for the old design, and for the new design is $553, or a saving of 33.5 per cent. For three-wire secondaries the cost was $1,095, and now is $772, or a saving of 29.5 per cent. To date, 13 miles of suspended secondary has been constructed, with an average span of 268 ft. Much of this has been added to the old No. 4 copper primary lines without setting any intermediate poles.

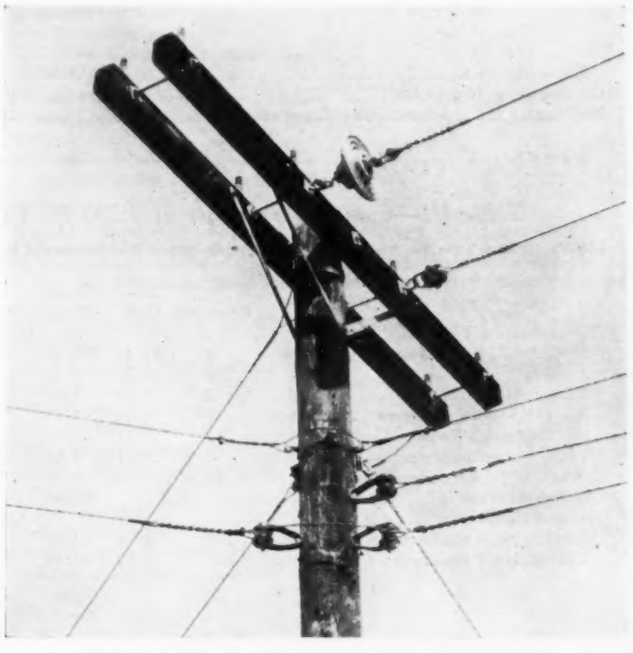
Another problem remained to be solved, for a 300-ft. spacing of poles was not convenient for services. Either the poles were too far from the customer's house, or trees interfered. Flying services as illustrated have been tried and found quite satisfactory. Full freedom in point of attachment permits the running of services in space free from trees or other obstructions. Heavy lines or long spans do not work out very well from the middle of the secondary spans, but this seldom causes trouble, since one can usually make the point of attachment, or pull-off, within 50 or 75 ft. from a pole, but if not, a light pole can be set for the service leads.

During the past winter the new lines were put to the most severe test to be expected for medium loading, when ¼ in. of sleet remained for ten days and at times with considerable wind. In no place did the lines fail.

Many readers will be interested to know what application the new types of construction have in the heavy loading zone. No. 4 copper can be used most economically (using Memphis prices) in 240-ft. spans on 30-ft. class 4 poles at a cost of $648 per mile. Three-strand No. 10 copperweld in 400-ft. spans on 30-ft. class 2 poles will cost $586, or a saving of 9.6 per cent. Two-wire copper secondaries (one No. 2 and one No. 4 triple braid, weatherproof) in 150-ft. spans on 35-ft. class 4 poles will cost $1,106, while suspended sec-



Suspension rack and a two-wire service from a farm line



End pole for a single-phase primary line, three-wire secondary and two-wire service

The grounded neutral or messenger dead ends to a thimble eyebolt, on the other end of which is an angle thimble eye for the anchor guy. Secondary dead-ends or insulated fork bolts are used to terminate the other secondary wires.

Table I—Comparative Costs of 1 Mile of Two-Wire, 7,000-Volt Line—Medium Loading

300-Ft. Spans, Two No. 4 Medium-Hard Drawn Bare Copper, 35-Ft. Poles

	Quantity	Unit Cost	Item Total	Total
Poles, towers and fixtures				$264.25
35-ft. A.S.A. No. 4 creosoted pine poles	18	$5.85	$105.30	
Anchors	1	1.76	1.76	
Anchor shields	1	1.78	1.78	
8-ft. creosoted pine crossarms	19	0.84	15.96	
No. 25009 strain insulators	1	0.18	0.18	
No. 1162 strain insulators	1	1.01	1.01	
50-ft. 3/No. 8 copperweld wire	7	0.18	1.26	
Labor and truck			137.00	
Overhead Conductors				242.14
11,100-ft. No. 4 medium hard-drawn copper wire	1399	0.11	153.89	
No. 6512 insulators	18	0.23	4.14	
No. A-133 insulators	18	0.10	1.80	
No. 2511 strain insulators	1	2.13	2.13	
No. 25009 strain insulators	1	0.18	0.18	
Labor and truck			80.00	
Contingencies, 10 per cent				50.64
Engineering and superintendence, 10 per cent				50.64
Total				$607.67

600-Ft. Spans, Two 3/No. 10 Extra-High-Strength Copperweld, 30-Ft. Poles

	Quantity	Unit Cost	Item Total	Total
Poles, towers and fixtures				$128.59
30-ft. A.S.A. No. 4 creosoted pine poles	9	$4.80	$43.20	
Anchors	1	1.76	1.76	
Anchor shields	1	1.78	1.78	
8-ft. creosoted pine crossarms	10	0.84	0.84	
No. 25009 strain insulators	1	0.18	0.18	
No. 1162 strain insulators	1	1.01	1.01	
50-ft. 3/No. 8 copperweld wire	7	0.18	1.26	
Labor and truck			71.00	
Overhead Conductors				268.82
11,100-ft. 3/No. 10 copperweld wire	966	0.19	183.54	
No. 6512 insulators	9	0.23	2.07	
No. A-133 insulators	9	0.10	0.90	
No. 2511 strain insulators	1	2.13	2.13	
No. 25009 strain insulators	1	0.18	0.18	
Labor and truck			80.00	
Contingencies, 10 per cent				39.74
Engineering and superintendence, 10 per cent				39.74
Total				$476.89
Per cent saving				21.5

Table II—Comparative Costs of 1,200 Ft. Two-Wire, 115-Volt Secondaries—Medium Loading

150-Ft. Spans, One No. 2 and One No. 4 Triple-Braid Weatherproof Wire, 35-Ft. Poles

	Quantity	Unit Cost	Item Total	Total
Poles, towers and fixtures				$129.34
35-ft. A.S.A. No. 4 creosoted pine poles	8	$5.85	$46.80	
Anchors	2	1.76	3.52	
Anchor shields	2	1.78	3.56	
No. 25009 strain insulators	2	0.18	0.36	
No. 1162 strain insulators	2	1.01	2.02	
Two-wire secondary racks	9	0.84	7.56	
100-ft. 3/No. 8 copperweld wire	14	0.18	2.52	
Labor and truck			63.00	
Overhead Conductors				80.13
1,260-ft. No. 4 weatherproof copper wire	207	0.11	22.77	
1,260-ft. No. 2 weatherproof copper wire	328	0.12	39.36	
Labor and truck			18.00	
Contingencies, 10 per cent				20.95
Engineering and superintendence, 10 per cent				20.95
Total				$251.37

300-Ft. Spans, One 3/No. 8 High-Strength Copperweld and One 3-Strand No. 2 Medium-Hard-Drawn Copper Wire, 30-Ft. Poles

	Quantity	Unit Cost	Item Total	Total
Poles, towers and fixtures				$65.20
30-ft. A.S.A. No. 4 creosoted pine poles	4	$4.80	$19.20	
Anchors	2	1.76	3.52	
Anchor shields	2	1.78	3.56	
No. 25009 strain insulators	2	0.18	0.36	
No. 1162 strain insulators	2	1.01	2.02	
100-ft. 3/No. 8 copperweld wire	14	0.18	2.52	
Labor and truck			34.0	
Overhead Conductors				86.73
1,260-ft. 3/No. 8 copperweld wire	169	0.18	30.42	
1,260-ft. No. 2 medium hard-drawn copper wire	252	0.12	30.24	
Dead-end cable bolts	2	0.24	0.48	
Insulated fork bolts	5	0.34	1.70	
One-hole side clamps	3	0.15	0.45	
Two-wire suspension secondary racks	8	0.43	3.44	
Labor and truck			20.00	
Contingencies, 10 per cent				15.19
Engineering and superintendence, 10 per cent				15.19
Total				$182.31
Per cent saving				27.5

Table III—Comparative Costs of 1,200 Ft. Three-Wire, 115/230-Volt Secondaries—Medium Loading

150-Ft. Spans, Two No. 2 and One No. 4 Triple-Braid Weatherproof Wire, 35-Ft. Poles

	Quantity	Unit Cost	Item Total	Total
Poles, towers, and fixtures				$130.87
35-ft. A.S.A. No. 4 creosoted pine poles	8	$5.85	$46.80	
Anchors	2	1.76	3.52	
Anchor shields	2	1.78	3.56	
No. 25009 strain insulators	2	0.18	0.36	
No. 1162 strain insulators	2	1.01	2.02	
Three-wire secondary racks	9	1.01	9.09	
100-ft. 3/No. 8 copperweld wire	14	0.18	2.52	
Labor and truck			63.00	
Overhead Conductors				128.37
1,260-ft. No. 4 weatherproof copper wire	207	0.11	22.77	
2,520-ft. No. 2 weatherproof copper wire	655	0.12	78.60	
Labor and truck			27.00	
Contingencies, 10 per cent				25.92
Engineering and superintendence, 10 per cent				25.92
Total				$311.08

300-Ft. Spans, One 3/No. 8 High-Strength Copperweld and Two 3-Strand No. 2 Medium Hard-Drawn Copper Wire, 30-Ft. Poles

	Quantity	Unit Cost	Item Total	Total
Poles, towers and fixtures				$66.68
30-ft. A.S.A. No. 4 creosoted pine poles	4	$4.80	$19.20	
Anchors	2	1.76	3.52	
Anchor shields	2	1.78	3.56	
No. 25009 strain insulators	2	0.19	0.36	
No. 1162 strain insulators	2	1.01	2.02	
100-ft. 3/No. 8 copperweld wire	14	0.18	2.52	
Labor and truck			35.50	
Overhead Conductors				126.67
1,260-ft. 3/No. 8 copperweld wire	169	0.18	30.42	
2,520-ft. No. 2 medium hard-drawn copper wire	504	0.12	60.48	
Dead-end cable bolts	2	0.24	0.48	
Insulated fork bolts	10	0.34	3.40	
One-hole side clamps	3	0.15	0.45	
Two-wire suspension secondary racks	8	0.43	3.44	
Labor and truck			28.00	
Contingencies, 10 per cent				19.34
Engineering and superintendence, 10 per cent				19.34
Total				$232.03
Per cent saving				25.4

Table IV—Comparative Cost of 1 Mile of Two-Wire, 7,000-Volt Line—Heavy Loading

240-Ft. Spans, Two No. 4 Bare Copper

	Quantity	Unit Cost	Item Total	Total
Poles, towers and fixtures				$296.91
30-ft. A.S.A. No. 4 creosoted pine poles	22	$4.80	$105.60	
Anchors	1	1.76	1.76	
Anchor shields	1	1.78	1.78	
8-ft. creosoted pine crossarms	23	0.84	19.32	
No. 25009 strain insulators	1	0.18	0.18	
No. 1162 strain insulators	1	1.01	1.01	
50-ft. 3/No. 8 copperweld wire	7	0.18	1.26	
Labor and truck			166.00	
Overhead Conductors				243.46
No. 11,100-ft. No. 4 medium hard-drawn wire	1399	0.11	153.89	
No. 6512 insulators	22	0.23	5.06	
No. A-133 insulators	22	0.10	2.20	
No. 2511 strain insulators	1	2.13	2.13	
No. 25009 strain insulators	1	0.18	0.18	
Labor and truck			80.00	
Contingencies, 10 per cent				54.04
Engineering and superintendence, 10 per cent				54.04
Total				$648.45

400-Ft. Spans, 3/No. 10 Copperweld, Extra-High Strength

	Quantity	Unit Cost	Item Total	Total
Poles, towers and fixtures				$217.99
30-ft. A.S.A. No. 2 creosoted pine poles	14	$6.60	$92.40	
Anchors	1	1.76	1.76	
Anchor shields	1	1.78	1.78	
8-ft. creosoted pine crossarms	15	0.84	12.60	
No. 25009 strain insulators	1	0.18	0.18	
No. 1162 strain insulators	1	1.01	1.01	
50-ft. 3/No. 8 copperweld wire	7	0.18	1.26	
Labor and truck			107.00	
Overhead Conductors				270.47
11,100-ft. 3/No. 10 copperweld, extra-high strength	966	0.19	183.54	
No. 6512 insulators	14	0.23	3.22	
No. A-133 insulators	14	0.10	1.40	
No. 2511 strain insulators	1	2.13	2.13	
No. 25009 strain insulators	1	0.18	0.18	
Labor and truck			80.00	
Contingencies, 10 per cent				48.84
Engineering and superintendence, 10 per cent				48.84
Total				$586.14
Per cent saving				9.6

Table V—Comparative Cost of 1,200-Ft. Two-Wire, 115-Volt Secondaries—Heavy Loading

150-Ft. Spans, One No. 2 and One No. 4 Triple-Braid Weatherproof Wire, 35-Ft. Poles

	Quantity	Unit Cost	Item Total	Total
Poles, towers and fixtures				$129.34
35-ft. A.S.A No. 4 creosoted pine poles	8	$5.85	$46.80	
Anchors	2	1.76	3.52	
Anchor shields	2	1.78	3.56	
No. 25009 strain insulators	2	0.18	0.36	
No. 1162 strain insulators	2	1. 1	2.02	
Two-wire secondary racks	9	0.84	7.56	
100-ft. 3/No. 8 copperweld wire	14	0.18	2.52	
Labor and truck			63.00	
Overhead Conductors				80.13
1,260-ft. No. 4 weatherproof copper wire	207	0.11	22.77	
1,260-ft. No. 2 weatherproof copper wire	328	0.12	39.36	
Labor and truck			18.00	
Contingencies, 10 per cent				20.95
Engineering and superintendence, 10 per cent				20.95
Total				$251.37

200-Ft. Spans, One 3/No. 8 High-Strength Copperweld and One 3-Strand No. 2 Medium Hard-Drawn Copper Wire, 30-Ft. Poles

	Quantity	Unit Cost	Item Total	Total
Poles, towers and fixtures				$88.80
30-ft. A.S.A. No. 4 creosoted pine poles	6	$4.80	$28.80	
Anchors	2	1.76	3.52	
Anchor shields	2	1.78	3.56	
No. 25009 strain insulators	2	0.18	0.36	
No. 1162 strain insulators	2	1.01	2.02	
100-ft. 3/No. 8 copperweld wire	14	0.18	2.52	
Labor and truck			48.00	
Overhead Conductors				88.25
1,260-ft. 3/No. 8 copperweld wire	169	0.18	30.42	
1,260-ft. No. 2 medium hard-drawn copper wire	252	0.12	30.24	
Dead-end cable bolts	2	0.24	0.48	
Insulated fork bolts	7	0.34	2.38	
One-hole side clamps	5	0.15	0.75	
Two-wire suspension secondary racks	6	0.43	2.58	
Labor and truck			21.40	
Contingencies, 10 per cent				17.71
Engineering and superintendence, 10 per cent				17.71
Total				$212.47
Per cent saving				15.5

Table VI—Comparative Cost of 1,200-Ft. Three-Wire, 115/230-Volt Secondaries—Heavy Loading

150-Ft. Spans, Two No. 2 and One No. 4 Triple-Braid Weatherproof Wire, 35-Ft. Poles

	Quantity	Unit Cost	Item Total	Total
Poles, towers and fixtures				$130.87
35-ft. A.S.A. No. 4 creosoted pine poles	8	$5.85	$46.80	
Anchors	2	1.76	3.52	
Anchor shields	2	1.78	3.56	
No. 25009 strain insulators	2	0.18	0.36	
No. 1162 strain insulators	2	1.01	2.02	
100-ft. 3/No. 8 copperweld wire	14	0.18	2.52	
Three-wire secondary racks	9	1.01	9.09	
Labor and truck			63.00	
Overhead Conductors				128.37
1,260-ft. No. 4 weatherproof copper wire	207	.11	22.77	
2,520-ft. No. 2 weatherproof copper wire	655	0.12	78.60	
Labor and truck			27.00	
Contingencies, 10 per cent				25.92
Engineering and superintendence, 10 per cent				25.92
Total				$311.08

200-Ft. Spans, One 3/No. 4 High-Strength Copperweld and Two 3-Strand No. 2 Medium Hard-Drawn Bare Copper Wire, 30-Ft. Poles

	Quantity	Unit Cost	Item Total	Total
Poles, towers and fixtures				$88.78
30-ft. A.S.A. No. 4 creosoted pine poles	6	$4.80	$28.80	
Anchors	2	1.76	3.52	
Anchor shields	2	1.78	3.56	
No. 25009 strain insulators	2	0.18	0.36	
No. 1162 strain insulators	2	1.01	2.02	
100-ft. 3/No. 8 copperweld wire	14	0.18	2.52	
Labor and truck			48.00	
Overhead Conductors				129.47
1,260-ft. 3/No. 8 copperweld wire	169	0.18	30.42	
2,520-ft. No. 2 medium hard-drawn copper wire	504	0.12	60.48	
Dead-end cable bolts	2	0.24	0.48	
Insulated fork bolts	14	0.34	4.76	
One-hole side clamps	5	0.15	0.75	
Two-wire suspension secondary racks	6	0.43	2.58	
Labor and truck			30.00	
Contingencies, 10 per cent				21.83
Engineering and superintendence, 10 per cent				21.83
Total				$261.91
Per cent saving				15.8

ondaries (one 3/No. 8 copperweld and one No. 2 copper) will cost $935, or a saving of 15.5 per cent. Three-wire secondaries would cost $1,369 and $1,152, or a saving of 15.8 per cent. In a rocky country the savings would be even greater because of the greater cost in setting poles. It is interesting to compare costs of adding secondaries to existing primary lines.

With a 300-ft. span primary line in the medium-loading zone intermediate poles will be required for plain copper secondaries. If one No. 4 and one No. 2 are used the cost would be $832 on a per mile basis, and similarly, $1,095 for a three-wire secondary of one No. 4 and two No. 2. If suspended secondary had been used of one 3/ No. 8 high-strength copperweld and one No. 2 copper the cost per mile would be $553, or $772 for a three-wire secondary, a saving of 33.5 and 29.5 per cent respectively, as no additional poles are needed.

With a 600-ft. span copperweld primary line in the medium-loading zone it would be necessary to set three intermediate poles for plain copper secondaries with a cost of $970 for two-wire and $1,233 for three-wire secondaries. Adding suspended secondaries will require only one intermediate pole at a cost of $678 per mile for two wires and $896 for three wires. The saving then would be 33.5 per cent for two-wire and 29.5 per cent for three-wire suspended secondaries on existing 300-ft. span lines, while on 600-ft. span lines the saving would be 30.1 and 27.3 per cent.

Similarly in the heavy-loading zone the savings would be 3.3 per cent for two-wire and 6.4 per cent for three-wire suspended secondaries added to 240-ft. span lines of No. 4 copper. In this case intermediate poles are necessary since 200 ft. is the span limit for the suspended secondaries. Adding suspended secondaries to 400-ft. span pole lines shows a saving over plain copper secondaries of 22.9 per cent for two-wire and 21.7 per cent for three-wire secondaries.

All estimates have been based on setting poles in compact clay soil. Had they been based on rock, or rocky soil, the savings would have been even more favorable for the new design.

Farms in west Tennessee are rather small, and with cheap negro labor only small loads can be expected from farm customers. On the new type of lines the average size of transformer is 4.2 kva.; the smallest used, 3 kva.; average customers per transformer, 2.44, and customers per mile of line, 3.6.

During the past decade many fine new arterial highways have been built radiating from our cities. These, together with the development of excellent low-priced automobiles, are encouraging people to live in the suburbs, while recent economic forces have been turning the tide from a cityward movement to a back-to-the-farm movement. The increasing farm and suburban population will soon be calling for electric service. Their homes, by force of circumstances, will be small, as will be the expected loads. For these, low-cost lines will be needed.

▼ ▼ ▼

South 4 per Cent, West 7 Above June

July marks the fourth month of the present industrial advance, noteworthy both for its magnitude and for the breadth of the front on which it is taking place. This statement applies equally to the country as a whole and to the several geographical regions.

On the basis of monthly returns giving energy consumption in identical plants the average of industrial activity in the South has risen 46 per cent since March, and for the West 24 per cent. Compared with July of last year the gains were 47 and 35 per cent, respectively. Reference to the charts shows these changes to be consistent with what has gone before. The decline in the West was more gradual than in the South and the recovery paths seem to correspond. The Southern average is strongly influenced by the textile industry, which has fluctuated widely. In the West the much more stable food industry is important and thus tends to limit the fluctuations in the regional average.

In the South the outstanding changes have been in the textile and in the iron and steel industry, both of them operating at twice the rate reported a year ago, with the former up 54 per cent from March and the latter nearly 140 per cent. Metal working advanced 55 per cent in three months.

In the West the year's increase of 54 per cent in forest products is conspicuous, although lately the changes have been moderate. The metals group doubled its operations, but the index for July, 1932, was so extraordinarily low that the present index is only half that recorded for July, 1929.

Other changes have been smaller, but have, with a single exception, been strongly upward in both regions during recent months.

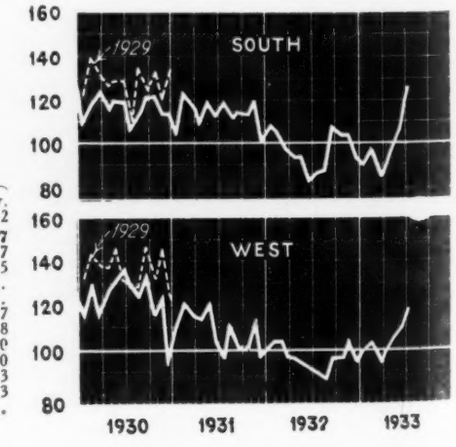
Index of monthly manufacturing activity, South and West

Base: Average month 1923-1925 = 100

(Corrected for number of working days, but not for seasonal variation)

Industrial Groups	South July, 1933	South June, 1933	South May, 1933	South Apr., 1933	South July, 1932	West July, 1933	West June, 1933	West May, 1933	West Apr., 1933	West July, 1932
All Industry	**125.0**	**119.8***	**103.9**	**99.8**	**85.3**	**119.0**	**111.6***	**107.0**	**103.2**	**88.7**
Chemicals	155.0	146.5	139.0	132.0	122.2	87.5	74.7*	77.5	82.4	88.7
Food products	170.7	160.4	149.8	148.2	157.5	132.2	126.0*	125.3	121.0	112.5
Iron and steel	142.4	125.7	93.8	98.5	73.7	....	....	....	....	....
Metal working	93.3	88.0	71.6	59.9	61.3	....	....	....	....	....
Metals group	121.0	108.9	84.1	81.5	68.2	69.7	62.2*	57.7	47.5	31.7
Forest products	54.4	49.6	43.3	37.2	31.6	160.0	154.0*	144.2	142.0	103.8
Paper and pulp	169.0	165.0*	148.0	141.4	119.0	153.0	159.7	139.2	130.0	120.0
Rubber products	148.4	146.3*	129.1	101.7	104.5	125.3	106.0	73.2	56.2	103.0
Shipbuilding	....	....	....	....	....	113.6	107.2	98.1	105.4	103.3
Stone, clay and glass	118.8	139.0*	113.0	145.3	95.7	117.0	107.8*	104.2	91.0	79.3
Textiles	146.0	146.3*	116.1	105.8	71.2	....	....	....	....	....

*Revision



Flashboard Resetting Platform Conserves Water

To speed up the replacement of flashboards on the dam at the Bellows Falls, Vt., generating plant of the New England Power System after floodwater begins to subside a resetting device for needle beams was designed by the engineering department under the supervision of E. A. Dow. Normal provision for flood control at Bellows Falls consists of two roller gates 115 ft. long x 18 ft. high and three bays of needle-type flashboards 12 ft. high. The capacity of the roller gates and turbine units usually suffices to handle the spring floods, but in case the flow exceeds this it becomes necessary to trip the needle beams and lift them by gantry crane to the flood position on the plant's spillway bridge.

The resetting device consists of a structural steel frame built in hinged sections and designed to swing outward and inward from pin bearings on the gantry frame as shown in the drawing. The crane hoist is utilized in raising and lowering the outfit. At the lower end is a platform carrying a water stop or duck plate 6 ft. high by 4 ft. wide at its outermost edge and raised and lowered by a worm-driven, self-locking hand winch on the upper part of the framing.

The device is used when the river has subsided to a depth of about 5½ ft. on the spillway crest. It is centered on a needle position by the crane and the water stop plate is lowered by the winch until it is in contact with the crest about a foot up-stream from the needle beam socket. This divides the waters sufficiently to clear the crest area immediately around the socket, permitting the crane to be utilized in lowering the needle beam into position, guidance being furnished by an attendant who stands on the lower platform grating virtually at water level. The water stop plate is then raised slightly and the crane moves to the next position, where the next needle beam is placed. In initial application last spring only four minutes per needle was required for replacement.

Water stop plate deflecting flow over socket while replacing needle beam

The water stop plate can be raised by the winch for transferring to next needle beam position; see Fig. 3. This relieves the water pressure against the structure.

Fig. 2—Resetting platform about 37 ft. long swung clear of pier

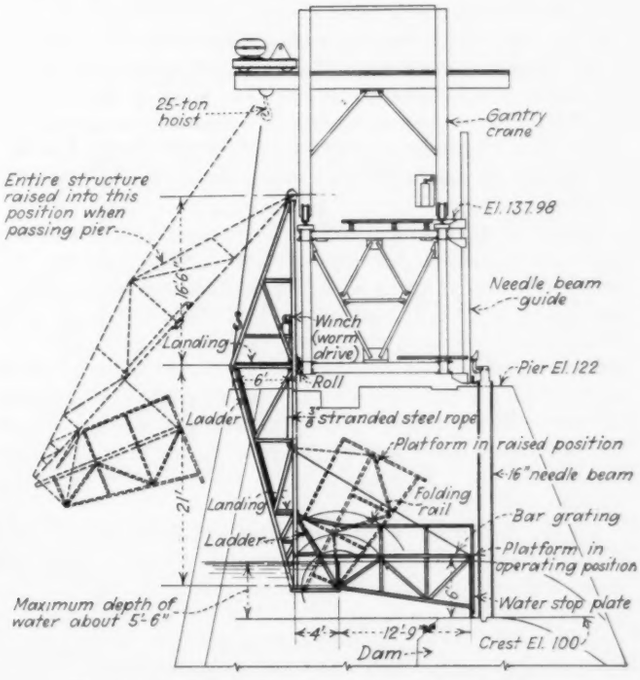


Fig. 3—Cross-section and elevation of gantry, spillway bridge and resetting device

At Bellows Falls it is necessary after replacing the needle beams on one 115-ft. bay of the crest to carry the resetting frame around a bridge pier to the next bay. This is accomplished by raising the duck foot and swinging clear upstream as shown in the dotted portion of the drawing and in the picture. The device has been so successful that a design may be made later to span the entire space between needle beams and facilitate placing flashboards and stop logs. By its use flashboards can be replaced and the Bellows Falls pond brought up to full height with a river flow of 30,000 sec.-ft., whereas formerly this could not be done until the flow had fallen to about 18,000 sec.-ft.

Cable Experience Shows Ups and Downs

ANALYSIS of high-voltage underground cable operation during 1932, as reported* by 60 companies in Canada and the United States, reveals some interesting comparisons:

The amount of high-voltage cable in operation increased during 1932 only 2.7 per cent, which is much below the average yearly increase for the previous seven years of 8.2 per cent. However, the amount of ordinary cable in service with oil reservoirs connected to the joints increased 30 per cent. The average rate of failure—5.1 failures per 100 mile-years—was 23 per cent lower than that during 1931. This pronounced decrease was produced almost entirely by a 27 per cent decrease in rate of failure due to non-inherent causes (3.1 per 100 mile-years). Most outstanding was a marked decrease in failures due to mechanical causes. Possible factors affecting the reduction in non-inherent causes may be curtailment of work around cables and subnormal loads, but the general decrease in evidence since 1926 is probably due to improved methods effected by operating companies. However, there is still much room for improvement as non-inherent causes constitute 61 per cent of all failures.

Cable failures which occurred during tests, after lines had been placed in service initially, increased from 18.5 per cent of all failures in 1930, to 23.6 per cent in 1931 and to 25.3 per cent in 1932. Of the latter, 61 per cent were due to non-inherent causes and 15 per cent unknown. In each of ten companies 40 per cent or more of their individual total cable, joint and pothead failures occurred during tests. While the average rate of failure for these companies was 61 per cent higher than for other companies, their average rate of failure in service was 12 per cent lower.

Cables insulated with varnished cambric and rubber showed an average rate of failure of 11.9 per 100 miles—more than double that for paper-insulated cable. Inherent causes were responsible for 1.1 and 1.6 failures per 100 miles in unimpregnated paper and in varnished cambric and rubber-insulated cables, respectively. These rates are practically the same as during the previous few years, indicating a consistently lower rate for paper-insulated cables. As during the previous year, three-conductor varnished cambric and rubber cables operating at 7.6 to 35 kv. had high average rates of failure—14.6 per 100 miles.

Considering impregnated paper cables the rates of failure due to inherent causes were 1.46, 1.06 and 1 per 100 miles for single-conductor, three-conductor shielded and three-conductor belted, respectively. The rate for shielded cable is unusually high because of excessive troubles in one city. The high rate for single-conductor cables was not due to any one system, but fourteen of the

Excerpts from report of N.E.L.A. subcommittee on cable operation. Herman Halperin (chairman), Commonwealth Edison Company.

Table I—Causes of Cable Failures for Fourteen Large Companies*

(Data from Electrical Testing Laboratories)

Cause of Failure	1932 No. of Failures	1932 Per Cent of Total	1931 No. of Failures	1931 Per Cent of Total
1. Initially defective cable	53	9.6	37	5.3
(a) Defective sheath	46	.....	31	.....
(b) Defective insulation	6	.....	6	.....
(c) Defective conductor	1	.....	0	.....
2. Deterioration	75	13.5	107	15.3
(a) In cable 3.1 to 10 years old	19	.....	29	.....
(b) In cable over 10 years old	56	.....	78	.....
Total, inherent	128	23.1	144	20.6
3. Corrosion of lead sheath	112	20.2	106	15.2
(a) Due to external currents	97	.....	57	.....
(b) Due to local galvanic action	11	.....	49	.....
(c) Due to chemical disintegration	4	.....	49	.....
4. Failure of adjacent cable	10	1.8	11	1.6
5. Lightning	0	0.0	1	0.1
6. Overheating	12	2.2	15	2.1
(a) Overloading	1	.....	3	.....
(b) External	11	.....	12	.....
7. Mechanical damage	163	29.4	266	38.0
(a) Vibration	4	.....	13	.....
(b) Wear at duct mouth	24	.....	49	.....
(c) Wear at hanger	9	.....	11	.....
(d) Expansion and contraction	9	.....	11	.....
(e) External cause (i. e., damaged by steam shovel, pick, "bull point," etc.)	60	.....	93	.....
(f) Damaged during installation	34	.....	57	.....
(g) Defective workmanship during installation	3	.....	5	.....
(h) Sharp bend	13	.....	18	.....
(i) Sheath damage due to soldering test point, bond wire, or patch	2	.....	3	.....
(j) Sheath destroyed by rats	1	.....	1	.....
(k) Severe handling of old cable	2	.....	2	.....
(l) Cracked sheath due to tension on vertical cable	1	.....	1	.....
(m) Sheath damaged by broken or imperfect duct	1	.....	0	.....
(n) Sheath damaged by ring cutting	0	.....	1	.....
(o) Sheath damaged by misplaced saddle	0	.....	1	.....
8. Moisture due to causes undetermined or unclassified	45	8.1	50	7.1
(a) Not attributable to any classified cause	44	.....	48	.....
(b) Defective end seal on cable	1	.....	1	.....
(c) Cracked filling cup on joint	0	.....	1	.....
9. Drainage of compound (vertical)	1	0.2	2	0.3
10. Sheath cracked open due to other causes	10	1.8	7	1.0
(a) High internal pressure	8	.....	0	.....
(b) Cause undetermined	2	.....	7	.....
11. Other causes	6	1.1	0	0.0
Total, non-inherent	359	64.8	460	65.7
12. Unknown causes	67	12.1	96	13.7
Grand total	554	100.0	700	100.0

*Had 69 per cent of cable on which reports were received.

45 failures were in 66- or 69-kv. cables of four companies.

The average electrical stresses at operating voltage in paper-insulated cable received during the last three years cover a wide range; 13-66 volts per mil for ordinary cable, 68-106 volts per mil for oil-filled cables.

Failures due to defective cable sheaths continued to increase in 1932. On the systems of fourteen large companies there were 46 failures of this type in 1932 and 31 in 1931. Besides, 27 lengths of cable were removed from service in anticipation of failure from initially defective sheaths. Corrosion caused 20.2 per cent of all cable failures. About one-eighth of these were due to galvanic or chemical action and the remainder due to external currents. The number of lengths of cable removed from service in anticipation of failure from mechanical damages increased from 40 in 1931 to 53 in 1932, indicating that close inspection was continued.

The number of inherent defects in the insulation of cables examined after removal because of failure or anticipated failure has decreased from 2.2 per length of cable in 1930 to 1.8 in 1931 and 1.3 in 1932, but defects found in sheaths are increasing. Defects in the insulation were largely in cable over ten years old.

About half the cable failures due to non-inherent causes or one-third of all cable failures could be prevented by more care on the part of operating companies. In many cases it would not be practical from an economic standpoint to eliminate most of the failures. As in previous years, about 36 per cent of all failures and anticipated failures occurred in manholes, which contain about 3 per cent of the cable. Analysis indicates that better provision is needed in manholes for cable movements and protection at duct mouths and supports.

Fourteen large companies having 69 per cent of the cable on which reports were obtained showed rates of cable and joint failure which were 32 and 7 per cent higher, respectively, than those for the 46 other companies. These differences were much greater in 1931, but the failures of the larger companies were 30 per cent lower in 1932 than in 1931, while the decrease for the other companies was only 10 per cent.

Except for a slight increase in 1931, the total rate of cable and joint failure has decreased steadily since 1926 and was, in 1932, less than half the rate in 1926. The decrease was about the same for cables operated at 7.6-19.9 kv. and for those operated at 20 kv. and over. Cable failures due to inherent causes decreased from 2.89 per 100 miles in 1926 to 1.07 in 1930, but slight increases occurred in 1931 and 1932.

Based on the operating records to date, little or no

*Table II—Causes of Anticipated Failures for Fourteen Large Companies**

Cable Operating Satisfactorily But Removed From Service in Anticipation of Failures
(Data from Electrical Testing Laboratories)

Cause of Removal	1932 No. of Cases	1932 Per Cent of Total	1931 No. of Cases	1931 Per Cent of Total
1. Initially defective cable	27	28.4	22	23.1
(a) Defective sheath	27	.....	22	.....
(b) Defective insulation	0	.....	0	.....
2. Deterioration in cable 3.1 to 10 years old	0	0.0	1	1.1
Total, inherent	27	28.4	23	24.2
3. Corrosion of sheath	3	3.2	11	11.5
(a) Due to external currents	1	.....	0	.....
(b) Due to local galvanic action	2	.....	11	.....
(c) Due to chemical disintegration	0	.....	.....	.....
4. Failure of adjacent cable	4	4.2	10	10.5
5. Overloading of cable	1	1.0	0	0.0
6. Mechanical damage	53	55.8	40	42.1
(a) Vibration	1	.....	0	.....
(b) Wear at duct mouth	19	.....	22	.....
(c) Wear at hanger	1	.....	0	.....
(d) Expansion and contraction	17	.....	3	.....
(e) External causes	3	.....	12	.....
(f) Damage during installation	8	.....	1	.....
(g) Defective workmanship during installation	1	.....	0	.....
(h) Sharp bend	2	.....	0	.....
(i) Severe handling of old cable	1	.....	0	.....
(j) Broken or imperfect duct	0	.....	2	.....
7. Moisture entering through defective joint wipe, patch or unknown cause	1	1.0	2	2.2
8. Ground current or short circuit burning hole through sheath	3	3.2	1	1.1
9. Sheath cracked open due to causes undetermined or unclassified	3	3.2	6	6.3
(a) High internal pressure	2	.....	4	.....
(b) Cause undetermined	1	.....	2	.....
Total, non-inherent	68	71.6	70	73.7
10. Unknown causes	0	0.0	2	2.1
Grand total	95	100.0	95	100.0

*Had 69 per cent of cable on which reports were received.

Table III—Defects or Evidence Found in Inherent and Anticipated Failures

Refers to failures shown in Tables I and II.
(Data from Electrical Testing Laboratories)
Each failure in which more than one type of defect was found is counted in more than one item below. The total number of failures involved is 167.

Defects or Evidence Found	No. of Cases	Per Cent of Total
1. Initial defects in sheath		
Split lead	24	8.3
Laminated lead	32	11.0
Blistered lead	3	1.0
Dross in lead	11	3.8
Eccentric and thin lead	15	5.2
Pin holes in lead	1	0.3
Defective lead (type not stated)	5	1.7
Total, sheath	91	31.3
2. Defects in insulation		
A. Cable 3 years old or less	9	3.1
Torn tapes	1	0.3
Tapes poorly applied	2	0.7
Incomplete saturation	2	0.7
Wrinkled insulation	4	1.4
B. Cable 3.1 to 10 years old	37	12.7
Wrinkling	3	1.0
Incomplete saturation	9	3.1
Torn tapes	1	0.3
Unstable compound ("X" present)	13	4.5
Ionization (carbonized paths present)	5	1.7
Charred or brittle tapes	5	1.7
Weak tapes	1	0.4
C. Cable over 10 years old	149	51.2
Wrinkling	37	12.7
Incomplete saturation	49	16.8
Soft insulation	4	1.4
Tapes poorly applied	4	1.4
Unstable compound ("X" present)	6	2.1
Ionization (carbonized paths present)	13	4.5
Charred and brittle tapes	16	5.5
Weak and torn tapes	19	6.5
Poor cabling	1	0.3
Total, insulation	195	67.0
3. Defective stranding of conductor		
A. Cable 3 years old or less	1	0.3
B. Cable 3.1 to 10 years old	1	0.4
C. Cable over 10 years old	3	1.0
Total, conductor	5	1.7
Grand total	291	100.0

Table IV — Estimated Preventability of Failures and Anticipated Failures Assigned to Non-Inherent Causes

(Data from Electrical Testing Laboratories)
Refers to fourteen companies for which data are given in Tables I, II and III

Cause of Failure	No. of Failures	Per Cent of Total
Preventable		
Corrosion of sheath:		
Due to external currents	13	3.1
Due to local galvanic action	6	1.4
Chemical disintegration	1	0.2
Damaged by an adjacent cable failure	4	0.9
Overheating due to external cause	1	0.2
Overloading of cable	2	0.5
Wear at duct mouth	41	9.6
Wear at hanger	10	2.4
Expansion and contraction	24	5.6
Injury during installation	26	6.1
Mechanical damage due to external cause	7	1.6
Sharp bend	15	3.5
Defective workmanship during installation	4	0.9
Other causes	14	3.3
Total	168	39.3
Preventability Uncertain		
Corrosion of sheath:		
Due to external currents	73	17.1
Due to local galvanic action	6	1.4
Chemical disintegration	3	0.7
Overheating due to external cause	2	0.5
Wear at duct mouth	2	0.5
Injury during installation	10	2.3
Mechanical damage due to external cause	33	7.7
Moisture in cable not attributable to any classified cause	2	0.5
Defective workmanship during installation	14	3.3
Total	145	34.0
Non-Preventable		
Corrosion of sheath:		
Due to external currents	12	2.8
Due to local galvanic action	1	0.2
Damaged by an adjacent cable failure	10	2.3
Overheating due to external cause	8	1.9
Vibration	5	1.2
Expansion and contraction	2	0.5
Injury during installation	6	1.4
Mechanical damage due to external cause	23	5.4
Moisture in cable not attributable to any classified cause	42	9.8
Defective workmanship during installation	5	1.2
Total	114	26.7
Grand total	427	100.0

improvement has been made in the average quality of high-voltage cable manufactured in the last four years.

Only about 10 per cent of the cable failures due to inherent causes occur within the first two years of operation, during which the manufacturer guarantees the cable. About double the rate of failure from inherent causes was experienced in cables operated at 66 kv. and more, compared with lower voltage cable, namely, 2.06 failures per 100 mile-years. Of the 67 failures or anticipated failures in 66- and 69-kv. cables, 29 were caused by defective sheath.

As in previous years, the rate of failure due to inherent causes in cables having oil reservoirs was higher (40 per cent) than for other paper-insulated cables, but most of the former either operate at high stresses or are of such quality that they would be operated at lower voltages if oil reservoirs were not used. Joints with oil reservoirs had a rate of failure due to inherent causes about the same as for joints without reservoirs.

No electric failures occurred in oil-filled cables or joints, but nine sections of 132-kv. cable were removed from service in Chicago because of increased dielectric losses, the cause of which has not been determined.

Some of the large operating companies had marked reductions in rates of cable and joint failure.

The average rate of failure for high-voltage joints (1.5 per 1,000 joint-years) was 25 per cent lower than during 1931. This was due largely to reduction in the rates for multiple-conductor joints operated at 15.1-35 kv., which in the past had high rates of failure. Joints operating at 20 kv. and more suffered only 1.74 failures per 1,000 joints in 1932, compared with 3.36 in 1931. Only a small decrease in rate of failures was experienced in 7.6-19.9-kv. joints. Considering only the joints on cables received in the last three years, there was a large increase in rate of failures for single-conductor cables, a slight increase for three-conductor belted cables and a large decrease for three-conductor shielded cables, compared with 1931. The rates for these three types of cable joints for 1932 were 2.13, 1.33 and 1.69 failures per 1,000 joint-years, respectively.

Failure of high-voltage potheads (three per 1,000 pothead-years) was slightly lower than during 1931. A large increase occurred in failures due to inferior design, but a decrease was experienced in failures due to inferior workmanship. Failures of potheads on varnished-cambric and rubber-insulated cables (6.1 per 1,000 pothead-years) occurred at a rate about twice that for potheads on paper-insulated cables (2.9).

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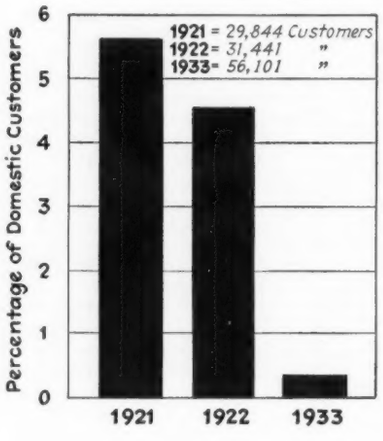
Promotional Rate Minimizes Bill Complaints



Steady reduction in rate, even though it involves area charges and a measure of added complexity through introduction of more blocks, tends to decrease greatly the number of inquiries and complaints about bills. This, at least, is the experience of the Hartford Electric Light Company over a period of twelve years, while the rate has gone from a value of 9.6 cents on a straight rate basis to an average of less than 5 cents including an area charge and promotionally tapered blocks.

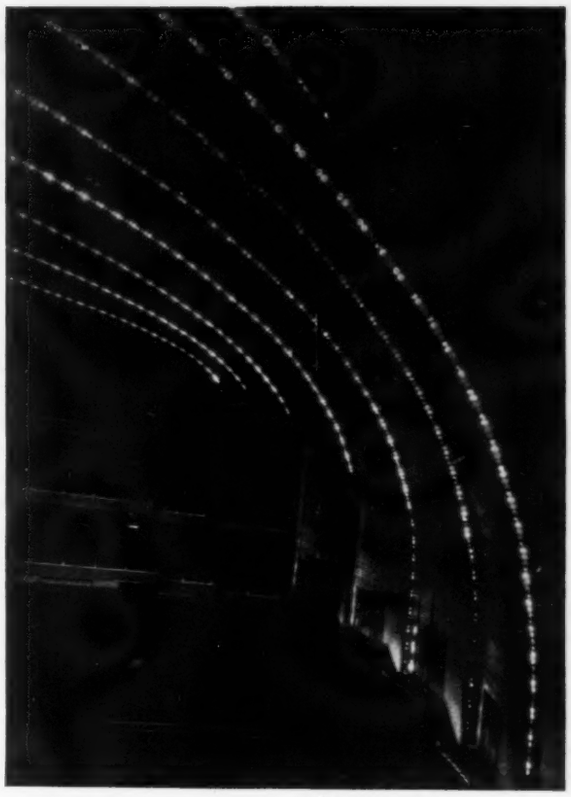
Even in 1922, following the introduction of the area charge, the monthly average percentage of customers who complained about their bills or asked for explication of the area charge during the first quarter decreased to 4.5 per cent from 5.6 for the same period in 1921, when the straight rate was in effect. In the eleven years which followed this percentage fell to 0.37 per cent (or slightly more than 200 of the 56,101 residential customers) for the first quarter of 1933. Even this figure might have been half as great if the visits, recently inaugurated, of a corps of young women to the homes on a service mission had not stimulated questions from customers.

Precision in leveling heavy stage sections and setting contour curtain.

Flexibility and centralization of control for all lighting.

Hundreds of Thyratrons and dimming reactors employed.

Selsyn motors used extensively for control and indications.



Refinement in Controls Marks Radio City Music Hall

THE Radio City Music Hall presents the largest stage so far attempted and with it goes magnitude in load, refinement of controls, intricacy of effects, reliability of performance and, of course, many new departures. Even if it be years before its size is surpassed, the advance made there will set a new standard for many a smaller theater. Industrial plants and commercial establishments too will profit, as always, by the new devices and new technique which only a job of such magnitude can subsidize through the necessarily expensive development stages. Suffice it to say that the elaborate controls devised for this 5,000-kw. load are greater in scope and perfection of reliability, centralization, interlocking and flexibility of the interconnected circuits than almost any comparable system so far established for localized power control. This is the result of exacting requirements imposed by S. L. Rothafel ("Roxy") in passing his conception of modern theater technique to the staff of Clyde R. Place, consulting engineer, for execution in collaboration with General Electric Company (Thyratron lighting control and Selsyn motors), Peter Clark, Inc. (stage lifts, curtains, etc.), and Kliegl Brothers (stage lighting).

Prominent among the developments are the following: At the compact lighting control panel in the pit in front of the stage there are 4,400 scene-preset dials and handles which can be flexibly grouped under masters for unified control of the whole auditorium and stage lighting. Some seven hundred Selsyn motors are also embraced in a similarly unified scheme so that the color screens of the spotlights can be synchronized and manipulated over a wide range of speed. The limit switches for the motors in this Selsyn system constituted a problem that was solved in an ingenious manner. These motors are also used in the stage lift controls. Booster transformers are incorporated to compensate for differential voltage drops in lines and in the dimming reactors. Footlights are arranged to disappear under a trap to leave a flush surface for transport of the orchestra "bandwagon" from front to back of stage or reverse. Interlocking of the hydraulic elevators and of the rotary section of the stage introduced many new concepts. So did the controls for the contour curtain.

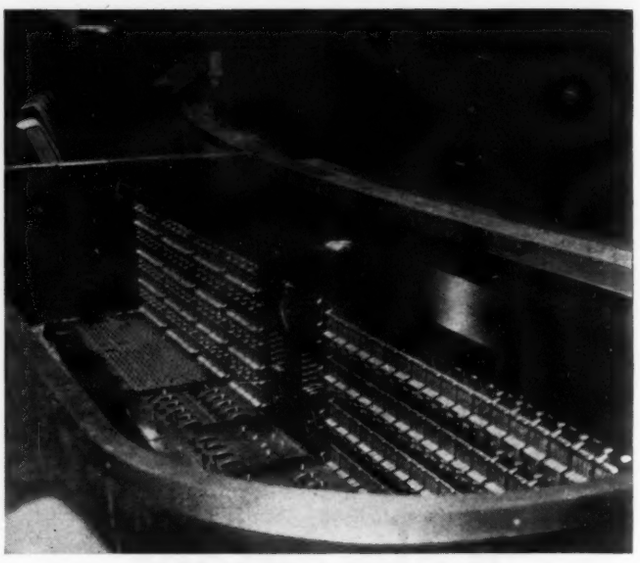
Stage consists of three elevators

Stage presentations of the pretentious character set as a standard by the Music Hall call for a high degree of precision and of flexibility in manipulating the stage levels, the scenery and the orchestra. The stage is built in three platform segments mounted on hydraulic ram elevators. There is a fourth section which carries the orchestra "bandwagon," which weighs 40,000 lb. loaded with musicians and instruments; it has a lift range of 28 ft. The three stage sections are each of 98,000 lb. dead-weight with a loading capacity of 40,000 additional pounds; they are 16 x 70 ft. in area and arranged for 40-ft. lift range. Parts of these three stage sections constitute segments of a 45-ft. circular section which can be rotated to effect quick change of scene or for revolving numbers. Rotation of this circular section can take place while the whole stage is being raised or lowered.

It is evident that intricate control and interlocking are

Fig. 1—All Radio City Music Hall lighting controlled from this control board adjoining the orchestra pit

A General Electric console type pilot control board with five presets and a rehearsal control per circuit. There are 314 individual control circuits, including ten supplementary and ten scene masters with scene fading. The controls are arranged for four colors in the auditorium and four for the stage.

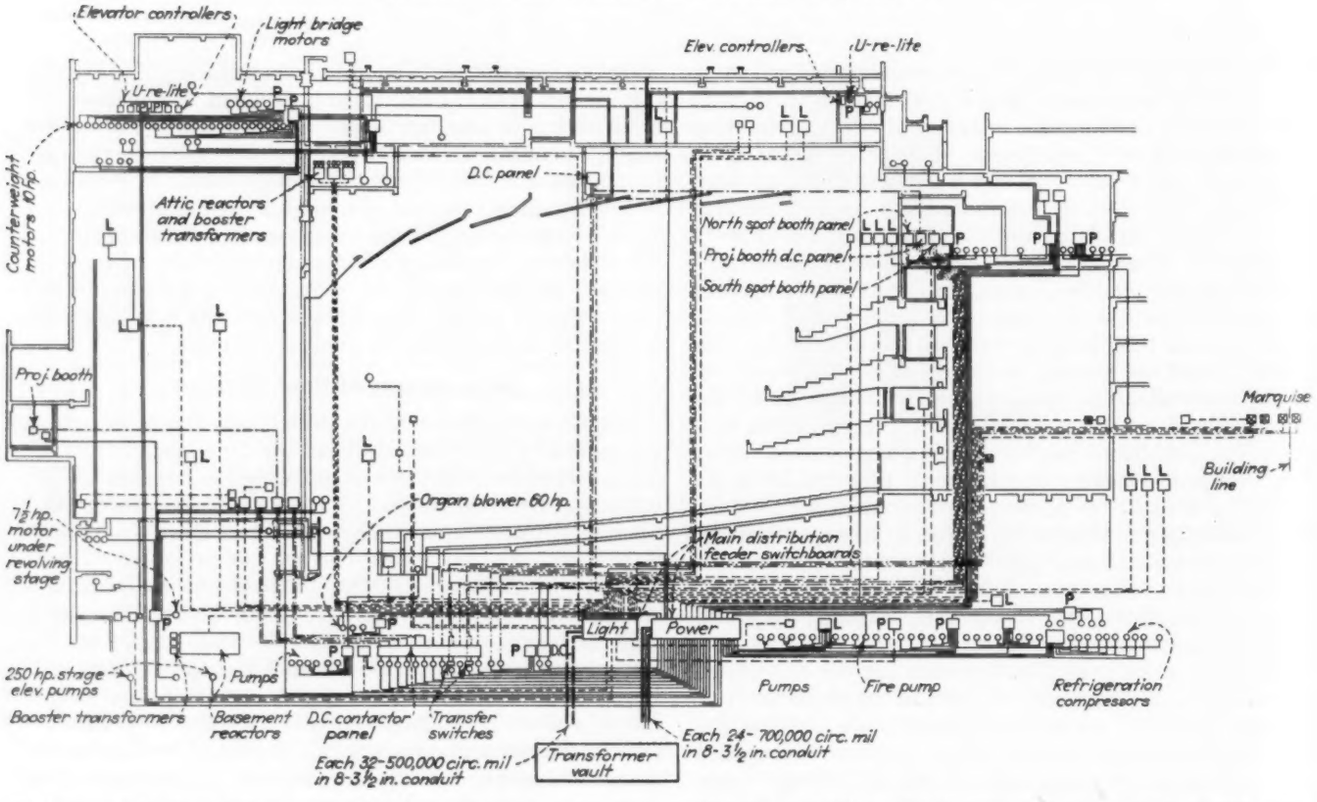


necessary to obtain the safety, the speed control, the leveling, the proper limits, etc., for these inter-related parts. For example, it is necessary that leveling be as fine as 1/16 in. for the elevator sections of the stage in order that the tracks for the circular segments can be brought to exactly the same level and thus insure smooth, noiseless travel of the rotating members. Also, the joints must match this close in order that the dancers shall have a smooth floor surface all over the stage area. This is effected by means of Selsyn-controlled auxiliary inching valves which act independently of the main hydraulic valves that feed the water to the 20-in. 250-lb. pressure elevating rams. The speed of the grosser travel is controlled by solenoid-operated pilot valves which manipulate the amount of water feed and discharge. The details of these controls are covered in the captions of the accompanying illustrations.

Likewise, the controls devised for the contour curtain and for the portals which govern the area of picture screen and the width and height of the stage opening have interesting elements. This control involves potentiometers and limit switches assembled on the same stage panel as the controls for the hydraulic elevators. The motors which manipulate these curtain functions are entirely remote control of a nature that gives a positive indication of the position assumed by the curtains and portals (see Fig. 8 for details).

Throughout the lighting installation the prime objective is to provide lighting control which will give light the opportunity to function as an impressionistic and esthetic

Fig. 2—Five vault compartments (three for power and two for lights) serve an estimated maximum demand of 2,900 kw.



Each vault has three 333-kva. transformers. There are also five secondary network ties to connect with the United Electric Light & Power Company's 13.2-kv. networks in the vicinity. Each power group is supplied by eight sets of three 700,000-circ.mil. cables for a 4,200-hp. total connected power load at 208 volts, three-wire. Each lighting group is served by eight sets of four 500,000-circ.mil cables for a total connected load of 3,300 kw. at 208 volts, four-wire.

adjunct to superior theatrical attainment. Many new principles, new devices and new methods were devised to accomplish this objective. Apart from the mere magnitude and multifarious functions to be co-ordinated, the principal aspects of the lighting requirements met by the design were:

1. Single control for auditorium and stage lights.
2. Preset selector control for the performances to be co-ordinated with flexible and independent control during rehearsals.
3. Means for varying illumination intensity simultaneously for any or all of the preset scenes.
4. Means for transferring any independent circuit to master control and vice versa.
5. Master control of rehearsal system to be operated independently or with grand stage master.
6. Supplementary master control to take advantage of certain circuits not engaged with scene masters. (This virtually makes the board a ten-scene board, although nominally called a five-scene board.
7. All scene masters susceptible of transition or "fusing" through "fader" control and proportional dimming.
8. Dimming to be proportional for all colors regardless of the actual intensity established for any bank of lights.

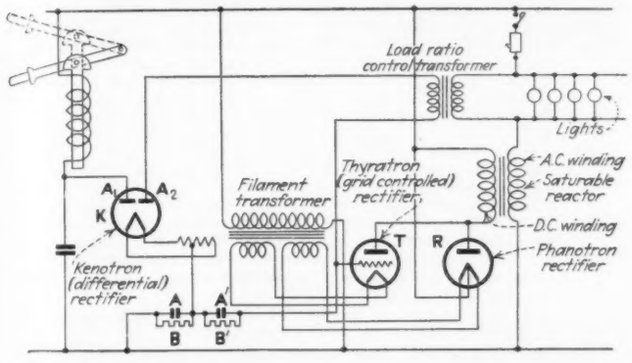


Fig. 3—Moving core reactors replace slide-wire potentiometers for Thyratron lighting control

Small inductors give smooth and compact control. A laminated iron core moves in a hollow magnet-frame type of coil and is easily adaptable to up-and-down dimmer handle scheme. When handle is down and the core is in the coil the impedance drop is maximum and voltage applied to anode A_1 of tube K is minimum. This voltage is also applied to condenser A' and resistor B' affecting the phase relation of Thyratron tube T, which then passes a minimum of rectified current to the d.c. winding of the saturable reactor. There will thus be a greater voltage drop across the a.c. winding and the lights will be dimmed out.

Past practice necessitated a simultaneous manipulation of individual dimmer handles to approximate sustained proportional dimming. Actually when these groups were operated it was impossible to change the intensity of a scene without disturbing the weight of individual colors which made up a scene. Proportional dimming with master control accomplishes the much desired result—preservation of color tone and balance in accordance with the preset proportioning as indicated by the accompanying schematic diagram.

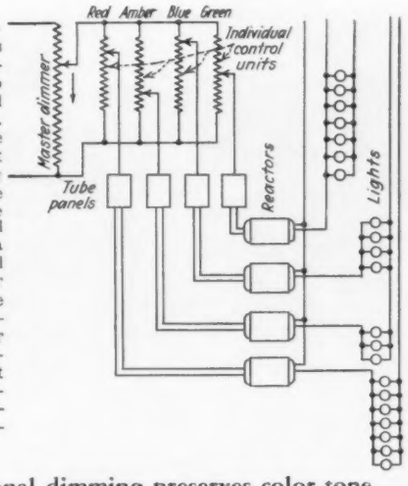


Fig. 4—Proportional dimming preserves color tone at all intensities

9. Color-changing of incandescent spotlights to be effected as fast as two seconds or as slow as twenty seconds.

Hundreds of tubes for lighting control

The pilot control board in the pit facing the stage has no power circuits. It is entirely a remote control board for some 1,313 kw. of lighting on the stage and 536 kw. in the auditorium. It has 314 circuit controls, each embracing five intensity regulators for each of the five possible preset scenes and an additional intensity regulator for rehearsal purposes. This necessitates the 4,400 operating handles which cover the face of the board (15 ft. long and 5 ft. 4 in. high). How these functions are accomplished is best grasped from the accompanying schematic diagrams which exhibit the details of the principle and the method in each case.

All told, there are more than 1,600 Thyratrons, Keno-

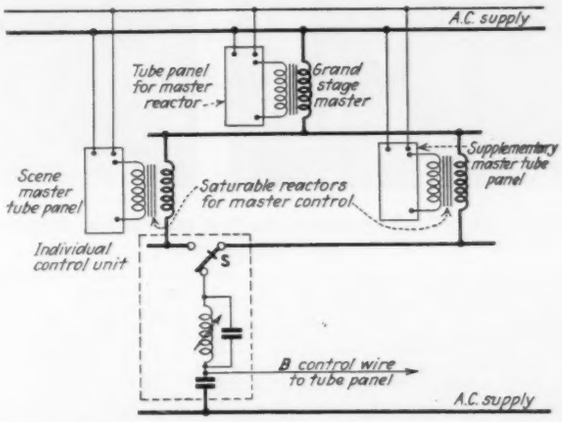


Fig. 5—Scene master voltage regulator dims all circuits set up for a scene

Ten scene masters are provided, five for stage and five for auditorium, so that there are as many scene masters as there are preset controls per circuit. In addition ten supplementary scene masters are provided, five for stage and five for auditorium. These supplementary masters make it possible to obtain a total of ten preset scenes, as any circuits which are to be used in a scene may be set up on the supplementary master and either brought in on an existing scene or, if included in the current scene, they may be taken from it. On each preset of all circuit controls a double-throw switch S is provided, one throw to scene master and one to supplementary master. When connected to the supplementary master the voltage of the inductor and, therefore, the voltage of the controlling tube is varied by means of the supplementary master.

Fig. 6—Transition from current scene to next effected by fader

Any scene may be selected regardless of physical arrangement. Two buttons are required per scene so that all control units may be connected by one button to a bus which at the time is at zero potential; as the scene fader is operated this voltage is brought to maximum. The other button for the same scene connects all control units to a bus which at the time is at maximum voltage, this voltage then to be decreased to zero by the fader. The pair of buttons for a scene are interlocked against simultaneous action.

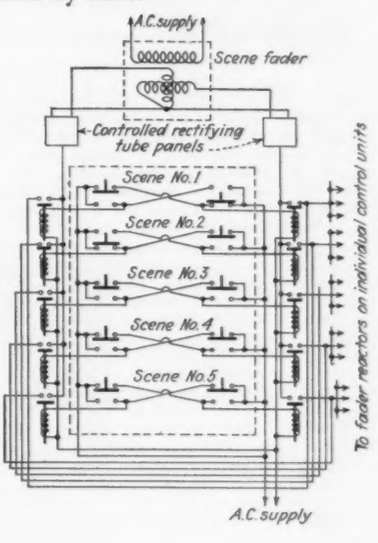


Fig. 7—Thyratron reactor panels for stage and auditorium

Front and back views of one of these dimmer-distribution boards; safety inclosures provided for units on panel front.

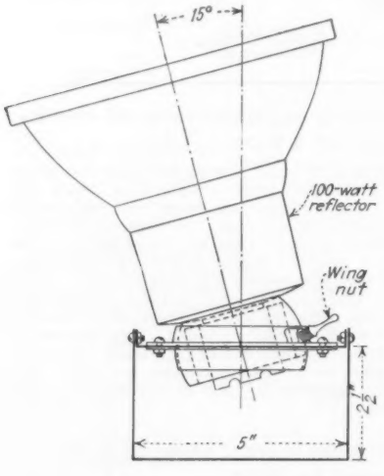


Fig. 9 — Universal joint for cove lights

The four-colored cove light strips have each light unit mounted on a wire trough with a universal joint that affords ample angular flexibility with simplicity. The running leads are tied directly to the terminals of the lamps, no pigtails being necessary to permit free motion of the lamp to any angle desired.

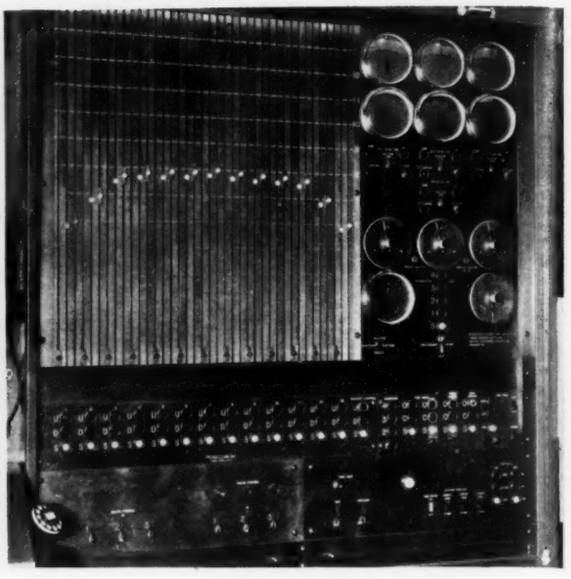


Fig. 8—Stage control panel for lifts and contour curtains

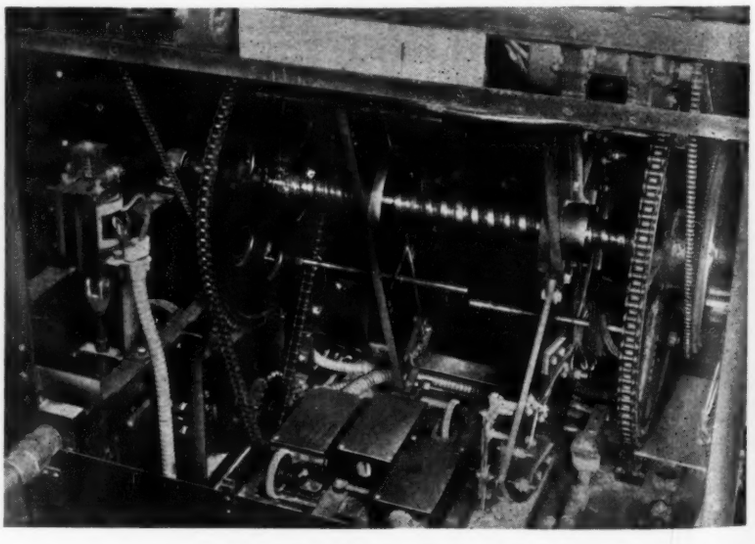
At the upper left is the preset control for the draped contour curtain, which is operated by individual motors driving thirteen cables attached at the bottom of the drape. The motion of the scallops of the curtain is transmitted by cords through a step-down gearing to the middle group of white buttons. The upper limit of travel is preset by the upper row of white buttons and the lower limit by the bottom row (red). They may be operated individually by push buttons or by the master control. At the upper right are the stage-lift controls. The top row of indicators shows the height of each of the three sections of stage in feet and inches (to eights). Next below are the similar preset dials for each section. When the level selectors are set and the operation initiated (as described in Fig. 10) the "follow" Selsyns attached to the lift indicators are actuated by the rising or lowering stage until the level is that preset on the selector to the nearest half division (1/16th in.).

Next below are the speed regulators which regulate the opening of the ports in the hydraulic valves. Ordinarily the three speed regulators are locked together so that all stage sections move at the same speed (this is imperative if the central circular section is being rotated); the valve for the middle lift then governs the speed for the others. Or the three may be unlocked and operated at different speeds to reach different preset levels in the same time. Directly below the elevator dials and buttons are the switch and button control for the magnoscope for screen size, the disappearing and tilting footlights (see Fig. 12), the silver screen (raise, lower, open and close portal), the steam curtain and the stage portals. Across the bottom are potentiometer type slide wires which regulate the height and width of the side and top curtains that establish the proscenium portal area for stage presentations.

Fig. 10—Leveling control for stage lifts

When the stage-elevating operation is initiated at the stage control board a small motor in the selector cabinet rotates the sprocket wheel at the left and a Selsyn transmitter coupled to it. The central lift wheel is meanwhile advanced by the motor along the square-thread shaft until it occupies a position corresponding to the desired level of the stage section. The Selsyn "follow" motor on the indicator (Fig. 8) has also meanwhile registered the preset indication.

When the next operation is performed the inlet valve (either for up or down motion of the lift) is operated, the stage moves in the desired direction at the desired speed and carries with it the rotation of the right-hand sprocket wheel and the central right contact wheel. This is then advanced along the shaft until its contact sectors engage the preset wheel. The hydraulic valves are then actuated to stop the stage movement. If the stage has overshot or fallen short more than 1/16th in. the inching valves (Fig. 11) are brought into play by supplementary contacts to establish the precise level. The inching valves are left functioning continuously to hold the stage at the normal level in the interval between stage presentations and performances.



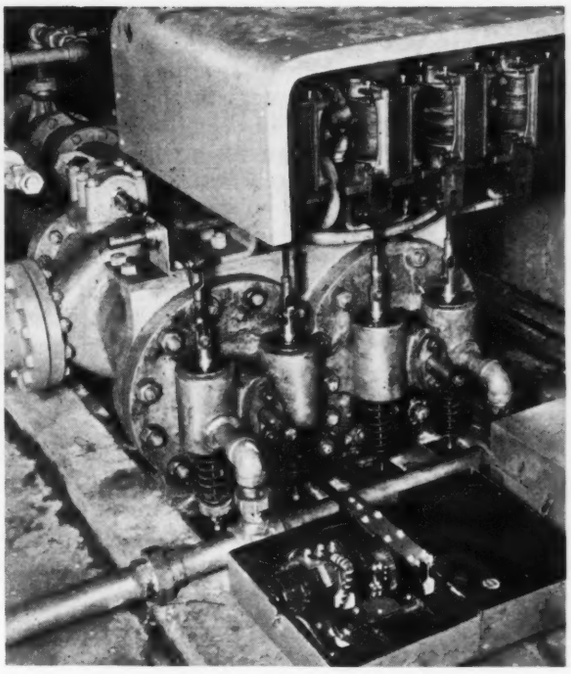


Fig. 11—Hydraulic valves for stage lifts

Each pair of rams on which a stage section is supported is governed by main inlet and discharge valves. The four solenoids which control the inlet and discharge sides (one of each for each lift and lower valve) are seen at the top front. In the lower left is the Selsyn "follow" motor which responds to the speed setting on the stage control panel and regulates the port opening. In the rear are Selsyns which operate the auxiliary valves and do the automatic inching for precise leveling.

trons and Phanotrons involved in the lighting control circuits. In addition there are about 350 saturable-core loading reactors, also miniature saturable-core reactors in the control circuits for the five-scene presets.

Voltage regulation is a very important factor in theater lighting. A small difference in the voltage applied to the lamps will have a marked effect on the light output. The circuits are so arranged that the line drop to the various groups of lighting fixtures vary over a large range. Furthermore, in many places, such as pockets, towers, bridges, etc., the load will vary in different scene settings by as much as 200 to 300 per cent. A system which will compensate for constant line drop and also provide load regulation over a wide latitude has been installed. Booster transformers of the auto-transformer type have been supplied at each reactor rack location and are connected in the incoming lines from the transformer substation. Taps are provided for adjustment. While these booster transformers compensate for the drop in the feeders and reactors, an automatic voltage regulating control which has no moving parts has been incorporated with the dimming control.

In Fig. 3 the Kenotron tube K functions as a differential between the voltage set on the individual control unit and the voltage applied to the lamp bus. If the voltage at the lamp bus tends to be below or above the voltage desired or set, this difference will, through the medium of the differential action of the tube K, affect the grid of the Thyratron tube T in such a manner as to cause it to pass current for a longer or shorter portion of each cycle, as the case may be, and consequently affect the saturation of the reactor and thus stabilize the voltage at the lamp bus.

In this installation the use at the control board of an inductor in the Thyratron-reactor dimming circuit replaces the potentiometer which has been employed in all but one or two previous theater installations. As the core of the inductor reaches position No. 1 on the intensity scale it introduces a supplementary Thyratron which, without opening the d.c. control circuit, makes possible the use of d.c. contactors and thus eliminates the chatter and noise of a.c. contactors. This is important because the reactor installations must be directly under the stage and directly over the proscenium arch.

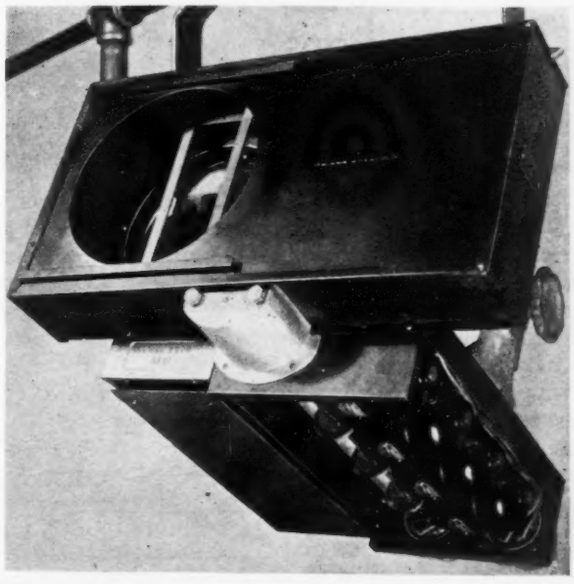
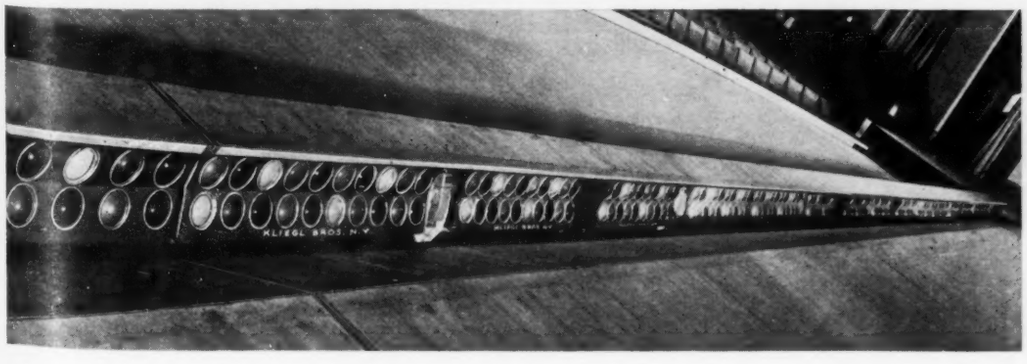


Fig. 13—Selsyns operate color screens

Four screens (green, red, amber, blue) moved before projector by separate Selsyn motors acting through concentric shafts.

Fig. 12—Tilting footlights under trapdoor for flush closure



To give a flush stage surface clear to the orchestra pit the footlights are placed under a motor-operated hinged trapdoor. The lights are also arranged to tilt so as to throw their beams straight upward along the face of the curtain as well as at a normal angle across the stage. One section of the trapdoor tilts downward; the other is raised horizontally along with the lights.

Spotlights and boomerangs are installed in the ceiling of the auditorium, in booths at the rear of the gallery, on bridges and towers on the stage. Color screens for four colors are operated by Selsyn motors through the medium of a gear and rack which slide them in front of the projector. About 640 of these Selsyn "follow" motors are required in addition to the 32 for boomerangs, and from three to fourteen of the "follow" Selsyns are supplied from a transmitter Selsyn, the latter operated by multispeed motors actuated from the master control board. Multispeed is necessary to meet the two-second or twenty-second extremes of color-changing speed.

The adjustable speed of the motors driving the Selsyn generators is obtained through pole-changing in conjunction with 6- and 8-cycle frequencies from special generator sets. Motors supplied with these adjustable frequencies are coupled to the Selsyn transmitters and operated therefore at the required speeds. Limit switches and time-delay devices prevent the overtravel of the "follow" motors and the consequent clashing of the color screens at the projectors. On reaching the limits of travel the excitation is removed from the transmitting and "follow" Selsyns after a time delay to insure positive stopping and phase relationship. Selsyns are also used as douser control by shutters for the 36 arc lights as an alternative to local manual control by the operators in the arc projection booths. Gelatin screens in 40 color tones are inserted manually in front of the arcs in accordance with the schedule established during rehearsal by the director as he calls all stations over the public address system connecting with the stage and the booths.

The entire power and light installation employs the new safety-type dead-front distribution switchboard, power panels and switch panels. Industrial type interchangeable branches continue the safety dead-front concept. Dead-front circuit breakers are used on the main power and light supplies and in distribution of all loads in excess of 400 amp.

The foregoing detailed information was obtained from Eugene Braun, electrical engineer for Radio City Music Hall; Edward B. Silverman, formerly electrical engineer with Clyde R. Place; H. V. Harding and R. M. Henderson, chief engineer and field superintendent for Peter Clark, Inc., and Herbert Kliegl of Kliegl Brothers.

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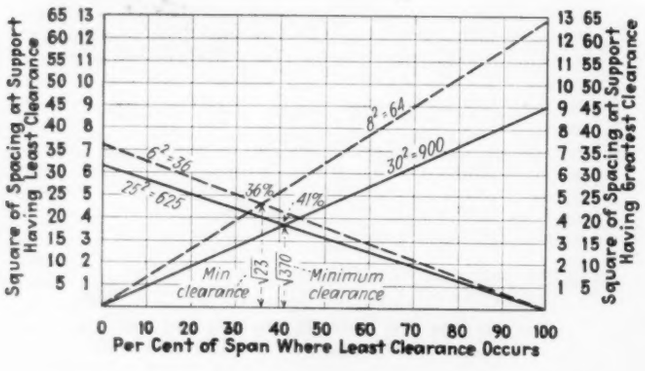
Determining Conductor Clearances at Transpositions

By ROY M. WALKER
Distribution Engineer El Paso Electric Company

Where transpositions or change from horizontal to vertical configuration occur it is usually desirable to check the minimum clearances between the conductors in the span and to locate the point of this minimum. A chart has been devised to aid in this determination. It is based upon the assumption of equal sags for all conductors. The geometrical principle upon which the chart is based calls for taking the square of both values of clearance at the supports. The minimum clearance value is also read as the square of the actual value. The vertical scales can of course be interpreted as either inches or feet and, to extend the range, it is convenient to have two scales with a five to one ratio of the unit markings. The amount by which separations at the supports may have to be increased can be determined by successive trials until the minimum clearance is found to be adequate.



Wire clearance at change from horizontal to vertical configuration determined from chart

The distance between the two conductors at the supports are squared and from the corresponding scale points lines are drawn to the zero of the opposite vertical scale. The co-ordinates of the intersection of these two lines indicate the (square of) minimum clearance and the per cent of span where that closest approach occurs. The full lines show the solution to be 19.25 in. for 25- and 30-in. separations, occurring at 41 per cent of span. The dotted lines apply to 6- and 8-ft. separations of transmission conductors and show a minimum of 4.8 ft.

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Diesel Engine Problems Include Many Unsolved Questions

That many difficult hurdles remain to be surmounted in Diesel engine application featured a recent discussion of this subject before the Boston section of the A.S.M.E., following an extended paper on the field of the oil engine in modern power development by Elliott Earl, consulting engineer, Boston. The author maintained that the oil engine industry had been one of the few to hold its own during the past four years, criticised former tendencies to exaggerate the value of the oil engine, pictured its progress, stressed the importance of giving this type of prime mover the same study lavished on steam-generating equipment and urged continued dissemination of over-all performance and cost data. Load characteristics are important in ultimate results, studying at least 60 days per year. Frequent peaks are disturbing to the best economy. The most important engineering problems remaining are the suitable silencing of Diesel engines and elimination of vibration.

H. J. Klotz of the Stone & Webster Engineering Corporation emplasized the importance of clearly defining the basis of comparison in contrasting steam and Diesel plants. Changes in fuel price may outweigh comparatively large differences in thermal efficiency. General statements as to the comparative operating economies of steam and Diesel plants are misleading and should be avoided. Too much stress cannot be laid upon the proper treatment and cooling of Diesel jacket water, and scale cannot be tolerated if continuous operation is desired. Some means must be provided for dissipating the heat from the cooling water in summer. Some may be used

in the hot water heating system, but this means of absorbing heat is usually inefficient, and some type of cooling tower or forced draft surface air cooler is required. City water is too costly to use once and discharge into the sewer. Extreme care must be exercised to remove all solid matter, wax and other foreign material from the fuel oil. A simple strainer is insufficient and a filter or centrifugal separator is necessary.

Results of the operation of Diesel engines to date indicate that Mr. Earl's claim of an inevitable trend away from the large central station for certain classes of power production is far from being an accomplished fact. The widest adoption of Diesel equipment so far has occurred in areas where large power stations are not economically feasible because of the length of transmission lines involved, but where Diesels are indicated because of fuel or water supply conditions. "Much remains to be accomplished before the smaller, high-speed Diesel engine can be considered to have inaugurated a general trend away from central station power," said Mr. Klotz. "Besides justifying itself economically, it must overcome the objections of noise, vibration, and space required, which are very serious in the usual central station territory."

Otto Nonnenbruck maintained that Diesels should be standardized like electric generators and all complexities eliminated. He declared that what is needed is an engine which will run six months to a year without stopping. It costs from $80 to $100 per kilowatt to install a Diesel plant complete, and on this investment the plant must earn at least $15 a year, or 5 mills per kilowatt-hour for fixed charges if the output is 3,000 kw.-hr. per kilowatt of capacity. Fuel oil, lubricating oil and repairs demand another 5 mills. Labor, in a three-shift plant, cannot be had for much less than $4,500 a year. In a 100-kw. plant labor will cost 2 cents per kilowatt-hour and in a 1,000-kw. installation probably 2 mills.

W. G. Starkweather, Boston, cited the utilization of larger Diesel units in municipal plants and commented on the advantage of keeping down the number of cylinders. Where these run up to ten or twelve per engine the crankshaft becomes unduly long and is liable to end-expansion and defective operation. Despite excellent endurance records, the speaker advocated checking up pins and bearings every 1,000 hours, removing cylinder heads every 2,000 hours and checking liners for wear, and every 3,000 hours shutting down the entire unit for general inspection. Diesel engines are not built to carry more than 10 per cent overload, so that careful selection of size is important, with enough units to carry over the peak. The oil consumption curve is very flat at different loads and the economy of small sizes approximates that of larger units. The speaker contended that where Bunker C oil can be obtained at 75 cents a barrel (42 gal.), a kilowatt-hour can be generated for 5 to 7 mills on a good load factor, with fixed charges at 12 per cent. While licensed engineers are not required for the operation of Diesels in Massachusetts, it is best to have first-class engineers in charge. Such equipment is not foolproof. Conditions for Diesel service are particularly favorable, Mr. Starkweather said, where the load factor is over 50 per cent, and also where the heat of jacket water and exhaust gases can be saved.

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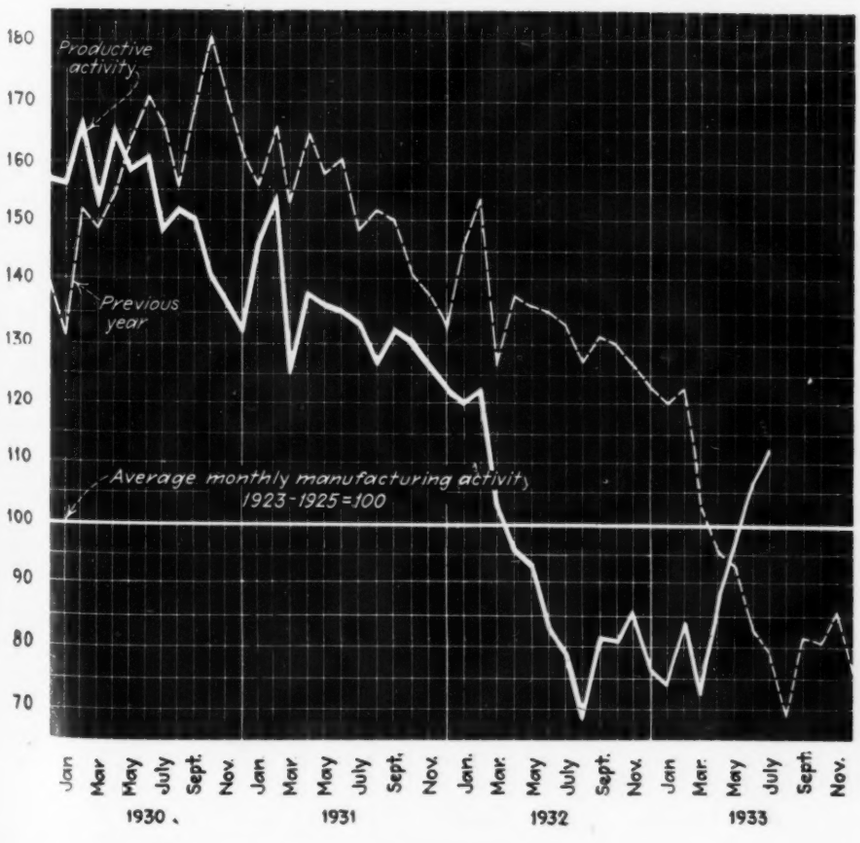
Electrical Industry More Active



Electrical manufacturing plants are becoming increasingly active, although the recovery has not carried them as far along the road to the level of former years as some other industries have gone. Measured by energy consumption, July was the fourth consecutive month in an advance which has amounted to 50 per cent since March. Compared with July of last year, when the downward sweep was in full swing, activity has increased 42 per cent.

Operations of some individual plants have been fluctuating quite widely, but the variations have largely balanced out in the totals for the industry, so that no discoverable trend is revealed as to the different branches.

Monthly Index of Electrical Manufacturing Activity

Adjusted to 26 working days

Base: Average Month, 1923-1925

Month	1930	1931	1932	1933
January	156.2	146.6	120.0	74.0
February	165.2	154.3	122.2	83.3
March	153.0	126.1	102.9	75.0
April	164.9	138.1	95.6	89.4
May	158.0	136.7	92.8	104.1
June	160.2	135.2	83.1	106.9
July	148.5	133.4	79.2	112.8
August	152.2	126.9	67.6	....
September	150.0	132.6	81.4	....
October	140.6	130.4	80.9	....
November	137.5	126.9	85.6	....
December	132.4	123.5	76.0	....

31 Canadian Homes Complete Season of Electric Heat

COMPLETE electric heating of 31 residences in the province of Quebec and one in Ontario was supplied on an experimental basis during the winter of 1932-33 for two distinct purposes. One was to aid in the creation of additional income for utilities temporarily having excess power. The other was to obtain a fairly definite idea of the rate which may be obtained from fairly well-to-do householders for such use, so the possibilities of this service as a permanent source of revenue may be considered.

An extensive report has just recently been presented by the Canadian Electrical Association* on the results obtained without commenting on the advisability of building such a load. In this report are presented the type and cost of apparatus, methods of installation and cost and results obtained as measured by cost and satisfaction in comparison with fuel. Only a few of the high spots can be presented here, and the reader is referred to the complete report for details.

The installations in Quebec were made by the local electric utility at its own expense. Payment for the use of the equipment and energy consumed was made by the householder under a two-year contract which provides a minimum charge to cover the company expenses and a fixed annual charge set at the average annual cost of fuel consumed in heating the particular residence during the three previous years, as near as could be obtained.

Actual results of these experiments showed that in the aggregate 68.5 per cent of the installation cost is earned the first year if surplus power used is not valued, and that the average return for energy used turned out to be 0.24 cent per kilowatt-hour. This figure was about 60 per cent of that expected from calculations involving the total amount of fuel reported and assumed efficiencies of fuel heating. Based on these tests maximum demand per house averaged 25.54 kw. The average demand per house for the season was 10.31 kw. and for February was 14.15 kw. For these periods the average load factors were 43.5 and 58.5 per cent, respectively. The total maximum demand was not measured, but is expected to approach the total connected demand on exceptionally cold, windy days, for the house temperatures were kept up to normal at such times. This is probably better service than had formerly been had with other fuels.

Results obtained in 27 houses divided into four groups classified by size, construction, type of heating and exposure to wind are given in Table I. Additional data are given in Table II for the individual houses.

It was concluded that, because of the cleanliness, comfort and convenience obtained by the users of these installations, those who can afford a little additional expense would be willing to pay 0.5 cent per kilowatt-hour rather than dispense with the service after several years' enjoyment, particularly if the rate is raised gradually as they learn to effect greater economy in the use of electric heat, which is possible to a surprising degree in the average residence.

Among observations made in the report are: (a) The exceptionally good construction and more sheltered location of the majority of houses in group A give them an advantage over others. In comparison with group D, which is representative of ordinarily good construction.

Room 409, Power Building, Montreal.

Table I—Electric House-Heating Data for Typical Groups

Group A—Well built of stone, brick or heavy wood construction; automatically controlled hot-water system; located in town X and very moderately exposed to wind.

Group B—One of wood with walls filled with sawdust and two of brick veneer; manually controlled hot-water system; located in town Y and moderately exposed to wind.

Group C—Wood construction with uninsulated walls; automatic pipeless-furnace hot-air heating; located in town Z with severe wind exposure.

Group D—Wood construction with walls and roof insulated with precast insulex; automatic hot-water heating; located in town Z with very severe wind exposure.

Item	Heating Season 1932-33				Month of February			
	A	B	C	D	A	B	C	D
Number of houses	9	3	7	8	9	3	7	8
Gross volume per house in cu. ft	54,700	23,900	16,500	20,500	54,700	23,900	16,500	20,500
Net volume per house in cu. ft	43,900	13,800	9,800	12,100	43,900	13,800	9,800	12,100
Ratio of net to gross volume	0.8026	0.5774	0.5939	0.5902	0.8026	0.5774	0.5939	0.5902
Kw.-hr. per house	90,839	61,993	42,554	64,344	13,513	8,169	5,568	8,717
Kw.-hr. per M. cu. ft. gross volume	1660.6	2593.0	2579.0	3138.7	247.0	341.7	337.5	425.2
Kw.-hr. per M. cu. ft. net volume	2069.2	4492.3	4342.2	5317.7	307.8	592.0	568.1	720.4
Av. kw. per house	13.8	9.4	6.5	10.0	20.4	12.2	8.3	13.0
Av. kw. per M. cu. ft. gross volume	0.2534	0.3959	0.3936	0.4790	0.3676	.5085	0.5022	0.6327
Av. kw. per M. cu. ft. net volume	0.3158	0.6856	0.6627	0.8116	0.4580	0.8810	0.8454	1.0720
Kw. maximum demand per house	34.5	13.7	14.8	26.3	34.5	13.7	14.8	26.3
Kw. maximum demand per M. cu. ft. gross volume	0.6307	0.5732	0.8969	1.2829	0.6307	0.5732	0.7879	1.2829
Kw. maximum demand per M. cu. ft. net volume	0.7859	0.9927	1.5102	2.1736	0.7859	0.9927	1.3265	2.1736
Load factor in per cent	40.18	69.07	43.88	37.34	58.28	88.71	56.15	49.32
Degree-days below 70 deg. F.	11,238	11,925	11,288	11,288	1,630	1,770	1,650	1,650
Kw.-hr. per M. cu. ft. gross volume per degree-day	0.1478	0.2175	0.2285	0.2781	0.1515	0.1931	0.2045	0.2577
Kw.-hr. per M. cu. ft. net volume per degree-day	.1841	.3767	0.3848	0.4711	0.1888	0.3345	0.3443	0.4367
Dollars revenue per house	220.33	120.00	99.00	161.88	.....	.....	.....	.....
Dollars revenue per M. cu. ft. gross volume	4.03	5.01	6.01	7.90	.....	.....	.....	.....
Dollars revenue per M. cu. ft. net volume	5.02	8.70	10.13	13.37	.....	.....	.....	.....
Equivalent fuel cost per Kw.-hr. in cents	0.2426	0.1936	0.2326	0.2516	.....	.....	.....	.....

Table II—Electric House-Heating Data for Individual Installations

No.	Type of House Construction	Group	Type of Control	Cu. Ft. Gross Volume	Kw.-Hr. per M. Cu. Ft. Gross Volume per Degree-day Below 70 Deg. F.	Est. Kw.-Hr. for Season*	Max. Dollars Contract	Equivalent Fuel Costs per Kw.-Hr. (cents)
1	Brick veneer and stucco	A	a	60,000	0.1084	73,090	$200.00	0.2736
2	Stone and wood-shingle siding	..	m	89,000	0.1405	140,510	.....	Meter rate
3	Wood with 2 in. pre-cast insulex	D	a	27,520	0.2452	76,160	205.00	0.2692
4	Stone, 3 in. hair felt, plaster	A	a	76,000	0.1252	106,910	210.00	0.1964
5	Brick veneer	..	a	37,000	0.1087	87,170	250.00	0.2868
6	Wood, practically no cellar, 100 years old	A	a	36,200	0.3251	132,240	340.00	0.2571
7	Cement block	A	a	27,000	0.1697	51,480	200.00	0.3885
8	Wood	A	a	51,000	0.2020	115,790	200.00	0.1727
9	Brick	A	a	68,000	0.1384	105,820	273.00	0.2580
10	Brick	A	a	82,000	0.0868	79,990	190.00	0.2375
11	Wood and prepared roofing	A	a	27,000	0.1807	54,840	120.00	0.2188
12	Wood	C	a	14,600	0.2100	34,600	95.00	0.2746
13	Brick veneer and stucco	A	a	65,000	0.1333	97,390	250.00	0.2567
14	Wood with 2 in. pre-cast insulex	D	a	13,200	0.3439	51,240	110.00	0.2147
15	Wood	C	a	14,400	0.2228	51,330	106.00	0.2065
16	Wood with 2 in. pre-cast insulex	D	a	19,600	0.2313	51,180	125.00	0.2442
17	Wood with rigid insulating wall-board	..	a	20,100	0.2780	63,080	160.00	0.2537
18	Wood with 2 in. pre-cast insulex	D	a	15,900	0.2699	48,430	120.00	0.2478
19	Wood with 2 in. pre-cast insulex	D	a	19,600	0.2519	55,730	205.00	0.3678
20	Wood	C	a	15,600	0.2695	47,460	96.00	0.2023
21	Brick	..	m	83,000	0.1798	167,730	390.00	0.2325
22	Wood	C	a	19,800	0.1743	38,970	90.00	0.2309
23	Wood	C	a	15,600	0.2718	47,860	105.00	0.2194
24	Wood	C	a	15,500	0.2364	41,370	96.00	0.2321
25	Wood with 2 in. pre-cast insulex	D	a	28,300	0.2630	84,020	205.00	0.2440
26	Wood with 2 in. pre-cast insulex	D	a	27,300	0.3116	96,020	205.00	0.2135
27	Wood	C	a	17,955	0.3215	36,290	105.00	0.2893
28	Wood with 2 in. pre-cast insulex	D	a	13,200	0.3488	51,970	120.00	0.2309
29	Wood with sawdust filler	B	m	22,660	0.1897	51,260	120.00	0.2341
30	Brick veneer	B	m	24,600	0.2562	75,170	120.00	0.1596
31	Brick veneer	B	m	24,600	0.2030	59,550	120.00	0.2015
32	Stucco, partially insulated†	..	m	33,800¶	0.0883†	25,950†	¼ct. Kw.-hr.	0.5000

*Based on data for period Oct. 1-Feb. 28, inclusive, with slight adjustments in some cases due to installation being not quite complete prior to Oct. 1.

†For season 1931-32. Data from experiment conducted by tenant anxious to keep heating costs at a minimum. Temperature range 65 to 70 deg. F. Heated floor area 1,207 sq. ft. Location Ottawa, Ont. All appliances considered as heaters, including uninsulated water tank with 3,000-watt element in basement. Air heaters located in individual rooms used for heating. Maximum recorded peak 14 kw.

¶Estimated. a Automatic control by thermostat. m Manual control by safety switch or other means.

the saving in power consumption by group A is 47 per cent referred to gross volume and 61 per cent by net volume. The saving in maximum demand is even greater—51 per cent by gross volume and 64 per cent by net volume. The greater saving in demand reflects the reduced effect of windy days on group A houses.

(b) Regulation of temperature by hand in group B houses, through a switch in the basement, is believed to lead to a higher average energy consumption per unit of volume, as it is easier to open a window than cut off the power.

(c) The houses of group C, heated by air from a single register, require 18 per cent less energy than the hot-water heated houses of group D, due apparently to the fact that they are a little more sheltered from wind than those of group D, necessity of keeping average house temperature below 70-72 deg. F. to avoid excessive temperatures near register and conditions conducive to opening the windows in group D houses.

(d) The air thermostat when applied to hot-water systems is more economical of energy than the water thermostat.

The units used for the hot-water heating were of the electrode type, consisting of a 4x23-in. iron tank containing a 1¼-2-in. (diameter) iron electrode, the assembly being piped in parallel with the fuel-fired hot-water furnaces previously used. They were rated at 25 kw., but tested up to 300 per cent rating, and operated at 31 kw. with full satisfaction. In some of the larger houses two electrode heaters were used per installation, one being automatically controlled and the other manually.

The hot-air heaters consisted of metal-clad space heaters rated at 20 kw. and mounted within the jackets of "pipeless" hot-air furnaces. The circuit was split into three groups—one 8-kw. automatically controlled and one 8-kw. and one 4-kw. manually controlled.

Each heater installation is supplied single phase at 440 or 550-volt (depending on local primary conditions) from special four-wire circuits fed by step-down transformers.

Based on eight hot-water installations involving single heaters the cost of everything from supply end of service entrance to and including heater averaged $118.28 per installation. The corresponding figure for eleven two-unit installations was $219.80 per installation. Seven hot-air heater installations averaged $157.65 apiece. Exclusive of the capital costs of transformers, which were either spares or rented, the average cost per installation for outside service facilities was $69.96 per installation. The total average installation cost, excluding development and transformer costs, was $241.79 per installation.

The electrode heater has a definite temperature-load characteristic as the specific resistance of the water changes with temperature. With high-resistance water at 125 deg. temperature the heater takes about 4 kw. By adding 7½ oz. of soda ash to the water in one installation the corresponding demand could be increased to around 17 kw. and rose to only 32 kw. at 200 deg. F. Provision is made so that soda ash may be injected into the systems to avoid sluggish temperature rise. Experience indicated that this would not have to be done more than two or three times a season with closed hot-water systems.

Particular attention was given to observation of explosive gas generation. Samples were collected from the top of the heater and radiators on the second and third floors. The maximum per cent of oxygen was found in a 700-cu.cm. sample collected over a period of 22 days, when the heater demand ranged 20-32 kw. The analysis showed 4 per cent oxygen by volume, 25 per cent hydrogen and the remainder inert gas. The sample, like all others, was non-explosive when subjected to an electric spark. When sufficient air was added to cause combustion in the presence of a spark a mild explosion, lacking any appreciable force, resulted, not even injuring the thin glass container.

One electrode heater which was examined for deterioration after operating the equivalent of one heating season showed no physical deterioration, except for a thin black deposit on the electrode composed of organic material and hydrated iron oxide.

Device Indicates Grease for Turbine Wicket Gates

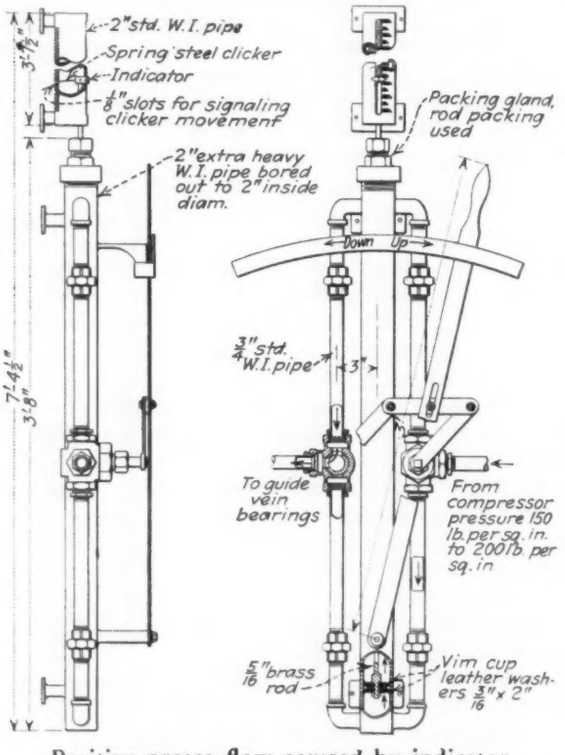
By B. B. BESSESEN

Superintendent Wilson Dam Power Plant, Florence, Ala.

In trying to hit upon a more positive method of lubricating submerged turbine bearings located where they cannot be readily inspected an improved lubricating scheme was devised for one of the large turbines at Muscle Shoals. Even with care it had been difficult to know just how well the upper and lower bearings of the turbine wicket gate were being lubricated by estimating a certain amount of grease passing through when the cock was turned. A central pressure system is used as a source of supply. The reservoir is acted on by air pressure of 175 to 200 lb. in this case. The pressure necessary depends on the grease friction of the lines.

Formerly when a grease cock was opened by the oiler at the time of greasing a bearing he estimated the time necessary for sufficient grease to flow. No account was taken of the difference in friction in the connecting pipes because of the different distances each cock is placed from the central supply and pressure source. The grease cocks for the turbine wicket gates are connected to a circular supply line about the top of the turbine housing. This circular line is of such a length that enough friction is set up to cause grease to flow only about half as fast when using a grease cock at the end of the line as compared to the speed of flow when using a cock near the grease meter.

The task requires a positive indication of flow of lubricant. At first a rotary indicator somewhat similar to a gear pump was tried without success. Then the principle of a moving plunger was tried and found to be satisfactory in the form shown in the illustration.



Positive grease flow assured by indicator

Arrows show the direction of flow.

Certain precautions were found necessary, among which were valves with true seats and cut-off to hold and direct the lubricant. Proper proportioning of the pipe connections was also necessary to take care of friction. The effective areas of the piston head were as near equal as possible on both sides in order to get approximately equal pressure to force the grease out on the opposite end of the cylinder. Another thing that had to be overcome was air leakage past the piston. This was done by using double cup leathers. Good seating valves were also necessary to prevent air leakage from the pressure system which caused erratic movements of the indicator. The operators are much pleased with the indicator because they are sure the proper amount of grease is received by each bearing every time it is greased. There seems to be approximately a 60 to 70 per cent saving of grease.

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Equipment Costs from Fifteen-Mile Falls

From the field sheets of the New England Power Association system have been taken the following items of equipment cost included in certain portions of the Fifteen-Mile Falls development on the upper Connecticut River. The plant rating is 156,000 kva.

Generators and Direct-Connected Exciters:		
Four 39,000-kva., 90 per cent power factor, 13.8-kv., three-phase, 60-cycle, vertical shaft generators, 138.5-r.p.m., umbrella type, each with one 210-kw., 250-volt and one 25-kw. pilot exciters. Generators have high-speed excitation, high reactance (short-circuit ratio 1.25) double amortisseur windings in rotor, efficiency over 97.5 per cent.		
Generator contract (machines erected)	'$891,300	
Transient reactance test	350	
Four sets of resistors	655	
2972 gal. lubricating oil	1,300	
Miscellaneous	856	
Haulage, etc.	18,726	
Total	$913,187	$5.85 per kva.
Power House Cranes:		
Two 115-ton cranes with 15-ton auxiliary hoists and 60-ft. 10-in. span (main hoist, 50 hp.; auxiliary, 30 hp.; trolley travel, 15 hp.; bridge travel, 30 hp.)		
Two cranes	$41,050	
Two crane hooks and crossbars	450	
One lifting beam	3,211	
Inspection, testing and erection	4,526	
Miscellaneous	108	
Total	$49,345	$214 per ton
Transformer Service Crane:		
One 90-ton, 30-ft. span (erected)	$16,016	$178 per ton rating
Transformers, Main Power Step-up:		
Fourteen water-cooled transformers, 13.8 kv. to 220 kv. (four banks of three single-phase units each and two spares), non-resonating, each transformer 13,000 kva.		
Banks erected	$506,451	$3.78 per kva.
Transformer Oil Storage Tanks:		
One 12,000-gal. and three 8,500-gal., ¼-in. plate, rivet and welded construction	$2,408	6.4 cents per gal. capacity
One transformer service truck	$1,112	
Oil Circuit Breakers, Main 230 Kv.:		
Seven, rating 800 amp., 230 kv.		
Cost, excluding foundations, with breakers erected	$339,160	$48,451 each
Rack Rake		
One 15-ft. 5-in. rack rake, with 5-hp. motor, installed	$7,285	

Men of the Industry

H. C. Abell Resigns Offices in Bond & Share Group

Harry C. Abell, prominently identified with the Electric Bond & Share group of public utilities since 1921, has resigned all offices and directorates in that company and its affiliates and is retiring from active business. Mr. Abell has been a vice-president of the Electric Bond & Share Company since he joined the system in 1921 and has been president of the National Power & Light Company since its formation in 1925. In addition to these offices, he has relinquished his position as director of National Power & Light Company, as vice-president and director of Electric Power & Light Corporation, as director and chairman of the Memphis Power & Light Company and as vice-president and director of the New Orleans Public Service Company.

Mr. Abell was born in Winnipeg, Man., and was graduated from the Armour Institute of Technology as a bachelor of science in electrical engineering in 1897. He was employed as an apprentice by the Canadian Pacific Railway in 1889, and later served with the Belding Motor Company of Chicago, the Canadian General Electric Company, the Anchor Line and the International Navigation Company. Following service in the Spanish-American War, he became associated with Emerson McMillin & Company, which supervised public utility companies, and later served with American Light & Traction Company, which was sponsored by the McMillin interests. For a number of years Mr. Abell took an active interest in the activities of the National Electric Light Association, having served as treasurer, and also in the American Gas Association, being a past-president of that society.

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Stanley Winborne has been designated by Governor Ehringhaus as public utilities commissioner of North Carolina. Mr. Winborne has served as a member of the present commission of three members, which, by an act of the 1933 Legislature, will cease to function January 1.

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H. C. Thomas, who has been connected with the Westinghouse Electric & Manufacturing Company continuously since 1910 with the exception of a short period of time spent in military service, has been appointed sales manager for "Micarta" products. During his association with the Westinghouse organization he has been in the repair department, supply department, salesman in the St. Louis office, assistant to the manager of the merchandising department, New York, in Mansfield, Ohio, and in East Pittsburgh, leaving the position of assistant to the general works manager there to assume his new duties.

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Harry S. Rogers, since 1927 dean of the school of engineering, Oregon State College, Corvallis, has resigned to become president of the Brooklyn Polytechnic Institute, Brooklyn. N. Y. Dean Rogers became identified with the staff of Oregon State in 1920 after holding the professorship of hydraulic engineering at the University of Washington. His successor at Oregon State College has not been announced.

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Llewellyn Evans, superintendent of the Tacoma Light & Power Department, has been appointed consulting technician for the Muscle Shoals project by A. E. Morgan, chairman of the Tennessee Valley Power Authority. Mr. Evans has been granted a leave of absence of from three to six months by the Tacoma department.

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Frederic A. Schaff has been elected president of Combustion Engineering Company, Inc., New York, recently organized to take over the properties of International Combustion Engineering Corporation and affiliated companies. Other officers include Joseph V. Santry, executive vice-president; Robert M. Gates, vice-president in charge of sales; Martens H. Isenberg, vice-president in charge of production, and John Van Brunt, vice-president in charge of engineering.

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Frank E. Case, assistant to the engineer of the transportation department of the General Electric Company at Erie, Pa., has retired after 42 years of service with the company. Entering the employ of the Thomson-Houston Company at Lynn, Mass., in 1891, he later served as engineer of the railway equipment department at Schenectady, and subsequently was transferred to the Erie works, where he was placed in charge of the motor and locomotive design divisions in addition to railway control. In 1930, when the design sections of the transportation department were consolidated with the general engineering division, he became assistant to the engineer of the department. More than 100 patents were taken out by Mr. Case, particularly in the field of control equipment. On four occasions he was sent to Europe in connection with engineering problems of foreign customers of the General Electric Company.

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Howell Ellis, who retired from the Indiana Public Service Commission recently after eight years of service, has announced the formation of Ellis & Guenther, public utility counselors, with headquarters in Indianapolis. W. J. Guenther, formerly engineer of the commission, is the other member of the firm. Prior to his appointment to the commission Mr. Ellis was its secretary and previously was an Indianapolis newspaper reporter. Mr. Guenther is a graduate of Purdue University and for eight years, prior to commission service, was with the Westinghouse Electric & Manufacturing Company.

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A. C. Wingo, design and construction engineer of the city of Los Angeles, Department of Water and Power, has been temporarily transferred to Denver to work with engineers of the U. S. Reclamation Bureau on the design of Hoover Dam power house. Mr. Wingo, who has long been associated with the bureau and has had diversified experience on the design and construction of power plants of all types, will act in a consulting and advisory capacity on the design and layout of the portion of the power plant which will be devoted to the seven 115,000-hp. generators which represent the city of Los Angeles' share of power to be obtained from this project.

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OBITUARY

Alden B. Wheeler, vice-president of the Gamewell Company, Newton, Mass., and for some years its New England sales manager, died at the Boston City Hospital August 17 as the result of an automobile accident. He was born at Littleton, Mass., 74 years ago and had been connected with the company for 45 years.

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W. B. Anthony, assistant to the president of the Oklahoma Gas & Electric Company for the past ten years, died August 11 at the Norman Hospital after an illness of a year. Mr. Anthony was a representative in the first three state legislatures and also served as speaker of the House. He was a member of the State Capital Commission from 1913 to 1919, then became city manager of Walters until 1923, when he joined the Oklahoma Gas & Electric Company. Mr. Anthony was 63 years of age.

New Equipment Available

Oil-Immersed, Explosion-Proof Switch

Oil-immersed combination switch, designated as CR7008, for use in class 1, group D hazardous gas locations, has been announced by the General Electric Company. The switch is available in three sizes for motors up to 50 hp. at 440 volts. The combination switch consists essentially of three parts: A magnetic switch, a motor circuit switch and a thermal overload relay which is reset by a plunger extending through the top cover. These parts, together with all connections, are located 6 in. below the surface of the oil in an oil-filled tank of welded construction. The tank, which is welded from heavy sheet steel, is supported from the top cover by four wing bolts. Handles on the sides of the tank facilitate its removal.

The magnetic switch used is of the same general construction as all General Electric magnetic switches. The motor switch is a manual contactor with a sturdy snap-action, quick-make, quick-break mechanism. This kind of disconnecting device is particularly suitable for operation under oil. The operating handle of the motor circuit switch is interlocked with the tank so that the tank cannot be removed unless the motor circuit switch is open.

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Arrester Shows High Efficiency of Dust Removal

An improved arrester which has a high efficiency of dust removal, averaging about 95 per cent for many installations, has been offered to America by C. Q. Campbell, 220 Bingham Street, Pittsburgh, Pa. There is also quite a reduction in sulphur fumes; one installation, which was designed especially for removal of sulphur gases, obtained 100 per cent removal of these gases and 100 per cent removal of solids in the stack gas, it is claimed. Known as the "Hanrez Modave" dust arrester it has no moving parts.

Some of the improvements are: The gases to be cleaned are brought in contact with a continuously changing film of water flowing over the entire surface of the vertical concave surfaced elements; this flow is controlled from a tank above the elements, where a constant level is maintained by a float valve. The elements are made of high-grade cast iron and are hollow. Water passes into each element from the head tank and then overflows the upper edges of the elements and runs down the sides in an unbroken film. The gases enter the arrester at right angles to the main axes of the elements and pass through in a swirling manner, bringing the dust particles in contact with the film of water. The dust particles become entrained in the water film, are carried to the bottom tank in the machine and are drawn off by regulating valves. The dust-laden water can then be wasted or clarified and recirculated, depending on local conditions and requirements.

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Safety Strap with New Features

Mathias Klein & Sons, Chicago, Ill., have announced a new safety strap known as "Klein-Kord." It is made of four-ply, heavy, close-woven, long-fiber cotton fabric, each laid in live rubber which is vulcanized to the fabric by a process similar to that used in making automobile tire. In regular transmission belting the longtitudinal fibers carry the load. The cross fibers are much lighter, and for this reason when used as linemen's safety straps it is necessary to assemble with a friction type buckle to avoid slitting at the tongue of the regular buckle, which invariably takes place at a comparatively light load.

Some of the advantages are: Great tensile strength; full factor of safety; long wear in service; extremely tough, resists damage from accidental cuts; weatherproof; uniformity of thickness and strength, and can be made in any length required.

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THE CORCORAN-BROWN LAMP COMPANY, Cincinnati, has announced a meter inclosure known as the C-B 14. Made of rust-resisting silicon aluminum alloy, this is the smallest meter inclosure for outdoor metering on the market, according to the manufacturer. It is ample in size to accommodate any type of bottom-connected meter in general use, disconnect and test device with adequate wiring space, it is claimed.

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PELLET LIGHTNING ARRESTERS for pole mounting, as offered by the General Electric Company, have been improved to involve: a single series gap in a sealed chamber, assuring permanent exclusion of atmospheric influences; a clamp-type ground terminal, which saves time and expense when installing; and a dual hanger, for mounting the arrester individually or in combination with a fuse cutout. The new units retain the inherent operating principles and characteristics of the previous designs. They are available in three ratings: neutral arrester, 300 to 1,000 volts; phase arresters, 1,000 to 3,000 volts delta, 3,000 to 5,000 volts grounded UY; and phase arrester, 3,000 to 6,000 volts delta, 5,000 to 9,000 volts grounded Y.

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Outdoor Meter Box

Exceptionally compact aluminum outdoor meter boxes have been announced by the Square D Company, Detroit, Mich. The wiring method indicates entrance of the service through the top. Load wires are then brought out through the bottom or the back of the box, as preferred. Ample wiring space is provided by the fact that the meter and the test block are elevated from the back of the box, permitting wires to be run underneath. The new test block employs the sequence of two-in, two-out, the line connections being brought into the meter through the two left-hand legs and the load through the two right-hand legs. Semi-rigid meter connectors permit the meter terminal chamber to slide down over them with ease.

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SINGLE-STAGE, BELT-DRIVEN COMPRESSORS designed for heavy-duty service, designated as class ES, have been announced by the Ingersoll-Rand Company, New York. These compressors have one horizontal, double-acting cylinder, operate at moderate speeds and are available in sizes from 10 to 125 hp. and for discharge pressures from 5 to 150 lb. They are suitable wherever full-load, continuous service is required and wherever power cost is an important consideration. Low air speeds and small pressure losses obtained by a liberal design of air passages and valves insure maximum economy.

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SHARPSVILLE FIVE-MINUTE OIL CHANGER, a time saver for motorists designed to simplify the routine of changing automobile motor oil, has been announced by the Sharpsville Boiler Works Company, Sharpsville, Pa. With the oil changer it is no longer necessary for a garage attendant to crawl under the car, open a petcock and let gravity drain the crankcase. Electrically driven pumps suck the oil from the crankcase through the dip-stick hole into a glass tank, where the car owner can see for himself the condition of the oil. If it should be changed the attendant merely throws a switch and the oil changer flushes the crankcase. If the oil is in good condition a reversible pump forces it back into the engine.